THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXVI.—No. 4 Whole No. 1,129. | NEW YORK, MONDAY, JANUARY 25, 1897. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES —

Thirteenth Annual Meeting, Ohio Gas Light Association..... 121

Twenty-seventh Annual Meeting, New England Association of Gas Engineers..... 121

EDITORIALS —

Briefly Told..... 122

The 1897 Meeting of the Ohio Gas Light Association—Secure Your Quarters in Advance—Notes.

Memorial Minute by the Society of Gas Lighting to the Late Mr. Joseph R. Thomas..... 122

Experiments on a 160 I.H.P. Gas Engine, Driven with Producer Gas, at the Bale Water Works, Switzerland, 1896..... 123

*The Holmes Apparatus for Washing Gas..... 125

*The Determination of the Cost of Electric Lighting by Gas Engine, by Messrs. J. L. Christy and S. A. Hasbrouck..... 125

Safeguards against Danger from Mine Gases and Falls of Coal and Roof..... 127

Photometric Values of Various Illuminants Employed in the Lighting of Mines, by Mr. A. H. Stokes..... 129

Special English Correspondence..... 130

Personal—Coke and the Motor Cars—Some Figures Respecting the Business of the Gas Light and Coke Company—Some Features of the Past Year.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 131

To Sell the Thomasville (Ga.) Plant at Auction—Minute to the Memory of Col. John W. Newell—Capital Stock Increased, Des Moines, Iowa—An Interesting Law Case, Frostburg, Md.—Annual Meeting, Ypsilanti, Mich.—Cheaper Gas for Chattanooga, Tenn.—Mr. Yorke Admits the Matter of Priority—The Louisville Company May Not Charge Meter Rent—The Sheepshead Bay (L. I.) Company Incorporated—Annual Meeting, St. Paul, Minn.—Annual Meeting, Hartford, Conn.—Death of Mr. J. P. Michellon—Annual Report, Louisville Company—Hotels Available for Visitors to the Gas Exhibition—The Projected Raid at San Rafael, Cal.—And Other Items.

Clearing Gasholder Inlet and Outlet Pipes of Naphthaline..... 133

Calcium Carbide: A New Reducing Agent..... 134

On the Use of High Voltage Lamps..... 134

The Market for Gas Securities..... 134

[OFFICIAL NOTICE.]

Thirteenth Annual Meeting, Ohio Gas Light Association.

THE OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
COLUMBUS, O., Jan. 4, 1897.

The thirteenth annual meeting of the Ohio Gas Light Association will be held in New York city, Wednesday and Thursday, February 3 and 4, 1897, in one of the parlors of Madison Square Garden.

Papers will be read by—

Mr. E. S. Templeton, Secretary and Treasurer Ashtabula (O.) Gas Company, on "Advertising."

Mr. T. C. Jones, Superintendent Gas Company, Delaware, O., on "Gas Stoves: Their Introduction, Construction and Use."

Mr. Irvin Butterworth, General Manager Gas Company, Columbus, O., on "A Curious Gas Explosion."

Mr. E. T. Lloyd, Secretary Western Gas Construction Company, Fort Wayne, Ind., on "The Large Gas Engine: Its Present Developments and Forecast of its Future for Electrical Purposes."

Mr. G. H. Christian, Superintendent Norwalk Gas Company, Norwalk, O., on "State Regulation of Corporations."

Mr. J. F. Seamon, Superintendent United Light Company, Uniontown, Pa., on "Some Facts Relating to Gas and Electricity."

The Question Box will be given more than its usual attention, and every member is earnestly requested to contribute to it.

One of the features of our meeting last year was the Executive Session, held on the morning of the second day. It afforded an opportunity for a freer exchange of ideas than is given in the regular sessions, and the Executive Committee have deemed it advisable to hold a similar meeting this year, on the morning of February 4.

Efforts have been made to get reduced railroad rates, but so far without success, excepting by the use of "party" ticket. In order to avail ourselves of these tickets it will be necessary for at least 10 to travel on one solid ticket on same train.

On account of its central location, as regards our membership, the Executive Committee thought it would be pleasant for as many as possible to meet at Columbus and leave there on the evening train, February 1, reaching New York city the next afternoon. Provided a sufficient number will arrange to go in this way, special sleeping cars can be secured for the exclusive use of our party. The rate of fare from Columbus to New York city, conditioned upon the use of this ticket, is $12.75, and charge for sleeping car berths is $3.50. Those who do not find it convenient to start from Columbus can get the advantage of the reduced rate, providing they can get a sufficient number to go in one party, as follows: From Cincinnati, $15.15; sleeping car berth, $4. From Cleveland, $11.90; sleeping car berth, $3.

In order that arrangements for a pleasant journey may be assured, the undersigned requests that all contemplating leaving with the Columbus party communicate with him, in order that ample sleeping car accommodations may be reserved.

The change in place of meeting was made by the Executive Committee, in accordance with a vote taken by the membership; and we hope that everyone who voted for the change will be present at the meeting, together with as many other gas men as can possibly find it convenient to attend.

Application blanks for membership can be obtained of the Secretary, who will be glad to furnish any further information.

A. P. LATHROP, Secretary.

[OFFICIAL NOTICE.]

Twenty-seventh Annual Meeting, New England Association of Gas Engineers.

OFFICE OF THE SECRETARY, LYNN, MASS., Jan. 20, 1897.

The twenty-seventh annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 17th and 18th, 1897.

The meeting will be called to order at 10 o'clock A.M., Wednesday,

February 17th. A list of papers, whose subjects will be enumerated later, will be presented, in addition to which time will be set apart for discussion of questions from the "Question Box" and "Short Topics," to which all members are urged to contribute.

C. F. PRICHARD, Secretary.

BRIEFLY TOLD.

THE 1897 MEETING OF THE OHIO GAS LIGHT ASSOCIATION.—A visitor to the office remarked the other day that the Ohio Association seemed to have determined on taking "long chances," in the instance of its Thirteenth Annual Meeting, through electing to hold that session in a place so far from home. Having considered the words of our visitor's expression of thought, the conclusion reached was that he referred to the number of the meeting, rather than to anything else connected with it; for a look over the programme put forth by Secretary Lathrop proves that the "Thirteenth" shall lack nothing in the instance of keeping the Association up to the records of the past "Twelve," so far as its technical history is concerned. Residents of New York, of course, have to be retiring, for fear that any proffer of hospitality might be construed as meaning that such hospitalities as may be offered were extended with the thought that requital should come at another time; but we think we are perfectly safe in declaring that the welcoming voices and the open hands of New York city's gas men, in their reception of the Ohio Gas Light Association, on the occasion of its "Thirteenth" annual meeting, may be listened to and grasped in the full belief that the voices are eloquent of sincerity, that the hands are bound in the clasp that accompanies honest fellowship. So we may say that, if there's such a thing as "luck in odd numbers," it will be the portion of the Ohio Association to enjoy double luck over its "Thirteenth" session, since technical advancement and fraternal reunion are to be the predominant features of its visit to New York, which even now is ruled by a son of Ohio. President Penn and Mayor Strong, however, can be safely trusted to see to it that their respective dignities will not be ruffled through any clash over conflict of authority.

SECURE YOUR QUARTERS IN ADVANCE.—Hospitality and advance in technical information, however, are best served when those who are to experience the one and absorb the other are comfortably housed. New York at this time of year is usually an attractive place, and the influx of visitors is such that even the capacity of its many and well-appointed and comfortable hotels is often taxed to the utmost, in which understanding the Ohio's members and guests would do well to remember that those who secure their quarters in advance are those who have acted prudently. In our item columns (p. 133, 1st column) will be found a list of hotels, with locations and rates, which possibly may aid those who propose to visit New York this week or next. Any of the houses listed will be found equal to affording comfortable quarters for those who propose to attend the Ohio's meeting and the display of the Gas Industries Company.

NOTES.—The Ways and Means Committee of Congress seem to have given scant and indifferent attention to the argument that a fair rate of duty should be placed upon tar and its products imported to this country. The argument in favor of a fair tax was made by Mr. M. S. Greenough, of Cleveland, O., whose proposed schedule, if it erred in any respect, erred in its lenience to the tar worker-up rather than in its beneficence to the American tar producer; but the truth is that the argument was evidently not in touch with the thought of the Committee. In fact, no argument would so be, for the tar workers have beyond doubt been seeing to it that the advantages gained in securing freedom for their especial need will be retained, for a while, in any event. It is nevertheless consoling, though, to know that the gas makers have the remedy in their own hands, and we have pleasure in announcing to the tar trust that one Company, the tar from which now goes into the trust's tanks, will not go there after the expiration of the existing contract. The Company produces several thousand barrels of tar each year, but in short time it will be worked up by the Company instead of by the trust. This method of procedure, if followed on on a fairly large scale, would make some difference to the tar producers, and to the tar trust workers as well.——The handsomest trade catalogue ever received by us is one recently forwarded by the United Gas Improvement Company, of Philadelphia. The get-up of the book could not be surpassed, no matter from what point its physical aspects are criticised. To be sure, its text is all in favor of the Company's gas plant system, but no matter what differences of opinion may be entertained as to the construction of its text, the way in which the text is arrayed is irreproachable.——At the annual meeting of the shareholders in the Newport (R. I.) Gas Light Company the following officers were chosen: Directors, Henry Bull, A. K. Quinn, James C. Swan, Thomas A. Lawton and Melville Bull; President, Henry Bull; Secretary, T. A. Lawton; Treasurer and Superintendent, A. K. Quinn.

Memorial Minute by the Society of Gas Lighting to the Late Mr. Joseph Russell Thomas.

At the January meeting of the Society of Gas Lighting the following minute respecting the Society's former President, the late Mr. Joseph Russell Thomas, was adopted:

To the Society of Gas Lighting, New York—Gentlemen:

Your Committee to express the sentiments of this Society upon the death of its President begs to submit that:

In the death of Joseph Russell Thomas, on Saturday, the 28th day of November, 1896, there passed out of this life one of the conspicuous men of the fraternity of American Gas Engineers, and an esteemed founder of this Society.

Mr. Thomas was born in Burlington, New Jersey, March 11th, 1820, and, as was the custom in those days, he received only that sound foundation for an education to be had in the public schools, and was early apprenticed to a mechanical trade, which served to develop the latent mechanical genius which afterward made him a prominent factor, in the early years of the gas business, as a constructor of gas works, a prominence which, in spite of the entrance upon his field of many well equipped competitors, was never shaken or questioned.

From 1854, Mr. Thomas gave his great ability almost entirely to the management of the Williamsburgh Gas Light Company, of Brooklyn, New York, and in that sphere of duty achieved a reputation as a careful, conservative and successful gas engineer, second to that of none of his contemporaries.

He demonstrated, by earnest and honest study of the principles underlying the profession he was practicing, the remarkable adaptability of the self-taught American engineer in combining daily study and practice in harmonious and successful practical results.

Closing his connection with the Williamsburgh Gas Light Company, in 1883, Mr. Thomas assumed the editorial direction of the AMERICAN GAS LIGHT JOURNAL, which relation continued until his death.

In this new field the same honesty of purpose, directness of thought and profound adherence to those things which his judgment selected as right marked his course.

Loyal to his friends and his convictions, he passed from this last phase of earthly activity respected alike for his righteous decisions and consideration of those who differed with him in opinion.

Long and useful as was the life of Mr. Thomas in his business and professional circle, his rugged, manly characteristics that made him ever a hater of shams, and the firm friend of honest, sincere men, will probably leave with this Society the most enduring recollections of him. Here we admired and respected, and, as men may, loved the staunch old gas man, whose helpful words of advice, and sharp, outspoken criticisms of our weaknesses, made him a valued preceptor to us younger men.

The twenty-five years during which he presided over this Society mark its birth and the development of its usefulness; and to no one member is it so largely indebted for the prominent position it has now reached as to our dead President, Joseph Russell Thomas.

As years pass and cares increase, the true friendships that bind men of a common calling together become stronger and draw them closer. The beckoning hand of Death summons friend after friend away, but the thoughts and words, undestroyed by death, remain and speak to us, and keep in tender recollection the kindly word, the good deed, the generous, manly effort that made their part in our life a gracious and pleasant memory. So shall it be with our friend, in rehearsing whose qualities of heart and mind we but place on the Society's records the evidence that we affectionately appreciated his numerous good traits, his sturdy professional worth, and the loss we have collectively and individually sustained in his taking off.

It is proper that we should add our word of sympathy to those who, yet nearer to Mr. Thomas, more keenly feel his loss; therefore, be it

Resolved, That the sympathy of the Society of Gas Lighting be extended to the wife and family of our late President, Mr. Joseph Russell Thomas, with the assurance of our profound sense of the loss which has befallen them through his death.

WM. HENRY WHITE,
FRED. S. BENSON,
A. M. SMITH,
} Committee.

Experiments on a 160 I.H.P. Gas Engine, Driven with Producer Gas, at the Bale Water Works, Switzerland, 1896.

Summarized Translation by MR. BRYAN DONKIN, in *Journal of Gas Lighting.*

The Deutz-Otto engine here tested consisted of two horizontal cylinders, placed opposite to each other, each with a piston working on to the same crank and crankshaft, and giving a total of 160-brake horse power with generator gas. It is used at Bâle to drive the town water works and pumps. Each cylinder has two exhaust valves, driven, like the gas and admission valves, by gearing from the main shaft. Ignition is by electricity, and the speed is regulated by a centrifugal ball governor. The exhaust valves are cooled by water injections against the seat, which also help to deaden the noise of the exhaust. Each cylinder is served by a separate gas receiver, to regulate the flow of gas. The crankshaft drives the pumpshaft by means of ten 2-inch ropes. There are three pumps, each 10.2 inches in diameter, and 27.5 inches stroke, going at a speed of 60 revolutions per minute. The engine is easily started in one or two minutes by a small water motor.

The gas producing plant below the engine room floor consists of three generators fired with gas coke, two small steam boilers for generating and superheating the steam, two sawdust purifiers, and four scrubbers. A superheating coil is placed in the center of each boiler above the furnace. Each generator has two steam jets to supply air and superheated steam. Originally, one gas engine fed by two generators was worked, the second engine and third generator being kept in reserve. But one generator produced sufficient gas for the engine, and during the trials here recorded, only one generator and boiler were used. The capacity of the gasholder was 1,765 cubic feet. The experiment (preceded by a preliminary or rehearsal trial) took place in April, 1896, and lasted 10 hours. As it was impossible to drive the engine with a brake attached, the work of the pumps in raising water was noted. To determine the quantity of water lifted per pump revolution, the water was measured for half an hour; and the volumetric efficiency of the pumps calculated was equal to 96 per cent. The height to which the water was raised was read off from a manometer gauge. Thermometers were fixed in the inlet and outlet pipes supplying water to each cylinder jacket; and the temperatures were read every five minutes. The quantities of jacket water were also determined, and the speed of the engine was shown by a counter on the crank. The heating value of the gas was tested every 10 or 15 minutes in a calorimeter. Thermometers were also used to take the temperature of the superheated steam, and of the steam and air below the jet, and indicator diagrams were taken every few minutes.

The following table gives the mean of the principal results:

Results of Ten Hours' Experiment on a Two-Cylinder Otto Gas Engine, April 9, 1896.

Mean number of revolutions per minute (gas engine)..	137.7
" " (pumps.....	58.5
Diameter of cylinders.....	20.4 in.
Stroke.....	30.0 in.
Height of water raised per minute.....	311.0 ft.
Mean indicated work (engine).....	178.3 I.H.P.
" " (pumps).....	131.9 I.H.P.
Efficiency of engine and pumps (131.9 ÷ 178.3).....	74 per cent.
Temperature of cold water into the jackets.....	9° C.
" of hot water out of the jacket.....	47° C.
" of the superheated steam for generator...	230° C.
Consumption of gas coke in generator (allowing for slack).....	2,252 lbs.
Consumption of gas coke in boiler (allowing for slack)	246 lbs.
Percentage of ash in the coke.....	8.40 per cent.
Gas consumption per I.H.P. hour (engine only).....	1.40 lbs.
" " (engine and pumps)	1.89 lbs.
Mechanical efficiency of engine (or 15 per cent. of I.H.P. to drive engine itself).....	85.00 per cent.
Consumption of coke per brake horse power hour taken at.....	1.60 lbs.
Heating value of gas (mean of samples in calorimeter) corrected for temperature and pressure, excluding condensation water.....	135 B.T.U. p.c. ft.
Heating value of gas, calculated from chemical analysis.....	134 B.T.U. "

The temperature of the cooling water out of the jacket was found to affect the mechanical efficiency of the engine. If it was too high, and the cylinder insufficiently cooled, the engine worked irregularly. The use of one generator instead of two increased the work done in water lifted per pound of coke 13 per cent., and diminished waste from the generator. The fuel used was coke from the gas works, having a heating value of 12,960 British thermal units per pound. The water for the generator, scrubbers, etc., was measured by a water meter, and the total quantity, including the engine jacket water, was found to be about 1 cubic foot per indicated horse power hour, or much less than that of a steam engine with jet condenser.

The chemical and physical properties of the coke, and the gas generated from it, were next studied. The gas coke, after sampling, was analyzed and found to contain 87.7 per cent. carbon, 9.7 per cent. ash, 0.6 per cent. water, and a small residuum of sulphur, hydrogen, oxygen and nitrogen. Tested in a Berthelot-Mahler bomb calorimeter, its mean heating value, after corrections, was determined at 12,963 British thermal units per pound. The power gas generated from this coke was chemically analyzed by Hempel's process, and the proportions of CO_2, CO, O, and $C_n H_{2n}$ were determined by fluid absorption. In former trials, air was then added to the residuum of gas, and the mixture brought in contact with a heated palladium wire, by means of which the hydrogen, but not the carbureted hydrogen, was burnt. The gases remaining after absorption—hydrogen and carbureted hydrygen—were in the present case mixed with a further quantity of hydrogen and air, and fired by an electric spark, The quantity of hydrogen was determined from the resulting contraction; the carbureted hydrogen from the carbonic acid generated.

The following table shows the chemical composition, heating value, etc., of the gas used in the trial; samples being taken every hour:

Table of Chemical Properties of Gas.

Gases.	Per Cent. by Volume in 1 Cubic Foot.	Weight at 0° C. and Ordinary Pressure per Cubic Foot.	Proportion by Weight in 1 Cubic Foot of Power Gas.	Heat of Combustion Developed by Volume per Cent. per Cubic Foot.
CO_2.....	4.8	0.1229 lb.	0.00590 lb.	—
CO.....	27.6	0.0782 "	0.02150 "	94.08 B.T.U.
CH_4.....	2.0	0.0447 "	0.00039 "	19.04 "
H.....	7.0	0.0056 "	0.00089 "	20.16 "
N.....	58.6	0.0782 "	0.04580 "	—
	100.0	—	0.07448 lb.	133.28 B.T.U.

One cubic foot of this gas weighs 0.074 lb.
One lb. occupies 13.5 cubic feet.
Heating value of the gas, 133.28 B.T.U. per cubic foot.

The heating values determined in a Junker calorimeter were corrected for temperature and pressure. It was found that for every cubic foot of gas burnt, 0.065 lb. of water was condensed in the calorimeter. Deducting the heating value of this water, the calorimetric heat value was 134.6 British thermal units per cubic foot. Including the condensation water, it was 140.4 British thermal units per cubic foot. Thus the results obtained agreed within 1 per cent. of those calculated from the chemical composition of the gas. The amount of water which should result from this quantity of power gas is rather less than that found in the calorimeter—due probably to condensed deposit of moisture. One cubic foot of this gas requires 1.05 cubic feet of air for combustion. To determine the efficiency of the gas producer, it was necessary to know the quantity of gas generated per pound of coke—that is, the percentage of CO_2, CO, and CH_4, the only constituents containing carbon. The proportions of these having been determined by chemical analysis and by calculation, 1 lb. of pure carbon burnt in the generator was reckoned to yield 86.5 cubic feet of power gas; or 1 lb. of coke, 75.9 cubic feet.

Taking the calorimetric results of the heating value of the gas as a basis, it was found that the heat efficiency of the generator was 71 per cent.; but this only applies if all the fuel is turned into gas, and there is no incombustible residuum. In this calculation, the coke consumed in the small boiler is added to that burnt in the producer. In other words, 29 per cent. of the heat given to the generator was lost.

The author next proceeds to study the processes of heat taking place in the generator, by means of equations of heat already made by him. He assumes the fuel in the generator to be pure carbon, the quantity of sulphur being so small that it may be neglected. The heat developed by the formation of carbureted hydrogen is not calculated separately, because the ultimate result is the same, whether the carbon and hydrogen in the fuel combine at once to form CO_2 and liquid HO_2, or whether carbureted hydrogen is first formed as an intermediate process. Thus, 1 lb. of carbon and ¼ lb. of hydrogen (the quantities considered in the original paper being 12 kilos. of carbon and 4 kilos. of hydrogen) develop 3,259 British thermal units. Oxygen and nitrogen,

and more hydrogen, are also present, but probably as solids, and not as separate elements. Even if supposed to be in a gaseous form, their value can be calculated, as forming part of the heat of decomposition. In any case, these various constituents ultimately become H_2O (steam) and CO_2. The author then draws the equation of heat for 1 lb. of generator carbon. Taking into account the heat required to generate and superheat the steam in the boiler, the following quantities must be found in the generator:

Heat evolved in the generator per pound of carbon by combustion to CO_2.....	2,021	B.T.U.
Do. by gasification of the CO and CH_4	3,695	"
Heat brought in with the steam.....	909	"
Total of positive heat.....	6,625	"
Deduct negative heat to decompose the coke and steam in the generator	2,995	"
	3,630	"

This latter figure represents the loss in the generator. To this must be added 428 British thermal units lost in the boiler, or a total loss of 4,058 British thermal units; making the efficiency of the generator and boiler by calculation 74 per cent.—a result which agrees practically with the former, reckoned from the heating value of the gas. If the temperature of the gases leaving the generator is known, the loss by radiation can also be determined. This temperature was given by a graphite thermometer at 665° C., and the loss by radiation thence calculated at 8.3 per cent., or 26 per cent., including the heat carried off in the gases. Supposing the gas to be made only from an airblast played upon the fuel, without the addition of steam, the production of carbureted hydrogen, which is formed partly from the hydrogen in the steam, will not be so large, and the efficiency of the generator will be reduced nearly 10 per cent. The introduction of steam also hinders the formation of slack, and cools the walls of the combustion chamber.

From these calculations, the heat balance of the engine tested was drawn as follows:

	Per Cent.
Heat turned into indicated work, or heat efficiency of engine (assuming combustion to be complete).	19.3
Do. in the cooling water.....	25.9
Do. carried off in the exhaust and by radiation ...	54.8
Total heat supplied to the engine.....	100.0

Of the total heat in the coke, 95.7 per cent. was available in the generator, and 4.3 per cent. lost in the boiler; 71.3 per cent. was available in the engine, and 24.4 per cent. lost in the generator—leaving 13.7 per cent. actually turned into indicated work. Part of these losses might doubtless be avoided by returning some of the heat to the generator and diminishing the loss by radiation; but the increased complication, if the air and steam were previously heated, would probably counterbalance the better heat results.

The author verified one singular fact, namely, that only 54 per cent. of the steam sent to the generator was decomposed, and 46 per cent. passed through it in its original condition. Heat was wasted in uselessly generating this steam, and the temperature of the generator was lowered; and for both these reasons it is important to know why all the steam was not decomposed. To determine this, the author made two experiments of three hours each—the first with one generator at work, and the second with two; the gas engine developing the same horse power continuously as in the test. Samples of the gases were taken and analyzed. The coke consumption of the generator, quantity of steam admitted, heating value of the gas, and amount of condensation water, were all determined, as also the temperature of the gases on leaving the generator. It was found that the percentage of hydrogen in the gas was 2.4 more, and of nitrogen 2.9 less, when working with one generator than with two. The temperature varied considerably; falling 50° C. two minutes after stoking, and rising again 50° three minutes later. These temperature variations are plotted graphically in curves in the original paper.

It appears probable that the gas generated always leaves the strata of the generator in which the chemical reactions take place at the same temperature, and becomes cooled while passing through the upper layer of fresh combustible. If this be taken for granted, it is easy to calculate how much heat passes from the gas to the coke, and is afterwards refunded, to produce a range of temperature of 50°. Probably the temperature of the lower strata is 30° to 50° higher than any temperature shown by the pyrometers as marking that of the gases leaving the generator; and the gases fall in temperature as they pass to the thermometer, owing to loss by radiation and other causes. The mean heating value of the gases in the first experiment, with one generator, was 133.9 British thermal units per cubic foot, and in the second 133.2 British thermal units, as determined in a calorimeter, and corrected for temperature and pressure. The coke consumption in the generator was 17 per cent. more working with two generators than with one; and as the power developed by the engine was practically the same, more heat was thus wasted with two generators. More steam was also injected, though the nozzle of the jet was smaller. With one generator, however, more steam was transformed into gas by chemical action; and the percentage of steam passing undecomposed through the generator was 31, as against 52 with two generators—a difference of 21 per cent. This was in spite of the fact that the speed of the steam was greater when one generator was used; and it shows that the time of contact between the steam and the glowing carbon has no effect upon the quantity decomposed. The temperature of the gases leaving the generator was 650° C. with one generator and 530° C. with two. Although the loss by radiation was practically the same, the author considers that only half as much heat was developed in the generator. It may be assumed that the hotter the generator, the more steam is decomposed. This seems to point to the desirability of previously heating the air drawn in; but two experiments are not sufficient to determine this difficult question.

Considering next the low heat efficiency of the gas engine tested (19.3 per cent.)—in other words, the percentage of heat turned into indicated work by the engine, to the total heat given to it in the gas—the author observes that the gas used was poor, of low heating value, and difficult to burn. In an experiment made by Köhler, in 1895, on a 30-brake horse power Deutz-Otto gas motor of the latest type, driven with lighting gas, the consumption was 17 cubic feet per brake horse power hour; and the heat efficiency was 30 per cent.[1] The engine tested at Bâle was of an older type, and the coke gas burnt slowly; combustion often continuing to the middle of the stroke. During the trial, the mean absolute pressure from the indicator diagrams at the end of combustion was 11 atmospheres, and the maximum pressure about 14 atmospheres. Thus the range was small. The absolute pressure of compression was 9.16 atmospheres. Heat was slowly evolved, and much was carried off in the exhaust gases, though less was lost to the cooling water. Electric ignition was used; but the author does not consider that the method of ignition affects the speed of combustion. A few experiments, however, gave a wholly different indicator diagram—showing practically instantaneous combustion—the explosion line was almost vertical, and the pressure of explosion was 20 atmospheres. These diagrams were always obtained when the speed of the engine was considerably increased for the time. The two phenomena certainly stand to each other as cause and effect. It appears probable that the greater speed of revolution produced more rapid ignition. At all events, as soon as the speed was reduced, the ignitions became less rapid, the mean indicated pressure lower, and the area of work smaller. Had these higher speeds and pressures been maintained throughout the trials, the heat efficiency would have been 23.8 per cent., instead of 19.3 per cent.; and the consumption of coke per indicated horse power hour, 1.1 lbs., instead of 1.4 lbs.

The absolute temperature at the end of the expansion stroke was 10 per cent. lower; and less heat was lost to the exhaust than with slower ignition. In the latter case, combustion was so slow as to be practically at constant pressure; while with rapid ignition, it was almost at constant volume. Thus explosion at constant volume appears to be more favorable to the efficiency of the engine; and this is in accordance with theory. For larger engines, however, combustion at constant pressure has much to recommend it. As the highest pressures are much smaller, and there is no sudden increase, the strain upon the piston rod and crank is not so great, and the engine works more smoothly. This method is also suited to 2-cycle, or even to double-acting engines; but at present the heat utilization is not so great. Perhaps longer expansion, higher compression, and a diminution in the heat carried off in the cooling water, may remedy this defect.

In conclusion, the author observes that the water pump efficiency in this trial was greater per pound of coke than has yet been obtained. At Bâle an auxiliary steam engine plant in an adjoining house, consisting of a twin-cylinder compound condensing engine, is kept in reserve. It is used to drive horizontal plunger pumps, and is served by three Tenbrink steam boilers. This steam engine, when developing 147 water horse power, or slightly more than the gas engine, gives only two-thirds the foot pounds of work (in water lifted) per pound of coke, as compared with the gas engine and generator. It is rather antiquated in type. The gas engine plant does not require more attendance than the steam engine and boiler, and it develops one-third more power. No

1. The translator has not succeeded in obtaining particulars of this trial.

inconvenience is found from tarry deposit. As a proof that a gas engine will work well and economically with producer gas made from coke from gas works, the trials on the Bâle motor are of value. The gas works are thus enabled to utilize their own coke to the best advantage; and the plant affords additional evidence of the value of producer gas for large power engines. Drawings of the generator and engine, and indicator and graphic diagrams, are given in the original paper. The experiments were made by Professor E. Meyer, and appeared in the "Zeitschrift des Vereines Deutscher Ingenieure," Oct. 24 and Nov. 7 and 14, 1896.

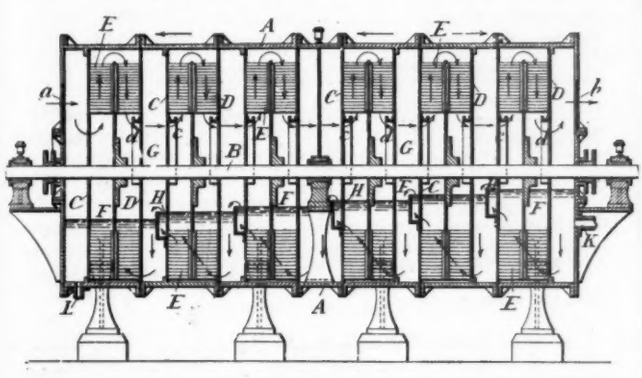
[*Note by the Translator.*—In a visit paid by him in 1896 to this large and interesting plant, he found it working satisfactorily in every respect. The ropes driving the water pumps from the engine seemed to work very well.]

The Holmes Apparatus for Washing Gas.

On January 5th U. S. Letters Patent (No. 574,683) were granted to Mr. Percy F. Holmes, of Huddersfield, England, for improvements in apparatus for washing gas. Using the words of the specification:

My invention relates to apparatus for washing combustible and other gases of the kind in which a number of disks, perforated or undulated or armed with brushes arranged on a horizontal shaft, revolve partly immersed in compartments of a vessel charged with water or other washing liquid.

The chief object of my invention is so to construct and arrange the compartments of the vessel and their communications that the washing liquid, which becomes more and more impure toward the end of the vessel where the gas enters, shall not flow back so as to vitiate the more



pure portions of the liquid toward the end where the washed gas issues. For this purpose I construct a washing apparatus as I shall describe, referring to the accompanying drawing, which is a longitudinal section.

Within a cylindrical casing *A* I mount a horizontal shaft *B*, which passes through stuffing boxes at the ends of the casing. The shaft may be arranged centrally in the casing, but when it is desired to sweep the bottom of the casing it may be mounted a little below the center, as shown in the drawing.

The casing *A* is divided by a number of partitions *C* and *D*, between each pair of which there is a revolving brush *E*. The partitions have openings by which gas admitted at one end of the vessel, as at *a*, can pass through *C* outward through one side of the brush, inward through the other side of the brush, and out through *D*, and so on successively through all the compartments of the vessel, of which there may be any desired number, finally issuing at *b*. The lower parts *F* of the compartments between each pair of the partitions *C* and *D*, and also the intermediate compartments *G*, are occupied by the washing liquid, which is supplied at *K* on the end whence the gas issues and is discharged at *L* at the end where the gas enters, flowing from compartment to compartment, the level at the entering end being lowered by steps to that at the issuing end; but each compartment *F*, in which the brushes revolve and in which the liquid is more or less agitated, communicates with the compartment *G*, not directly, but through a weir *H*, so that the compartment *G*, from which the next compartment *F* in order is supplied at the bottom, remains comparatively still and operates as a kind of liquid seal, preventing the more impure liquid on the left from going back to mingle with the less impure on the right. The edges of the holes through the partitions *C* and *D* are also armed with shields *c d*, having lips to catch spray and direct it downward.

When, instead of brushes, plain, perforated or corrugated disks are employed, the gas may be led radially inward through one set of these and radially outward through another set. In these cases, however, I retain still compartments, such as *G*, dividing the liquid in one compartment from that in the next, so as to prevent their mixture, as above described.

The Determination of the Cost of Electric Lighting by Gas Engine.[1]

By Messrs. J. L. Christy, M.E., and S. A. Hasbrouck, M.E., in the *Stevens Indicator*.

The plant consists of a 10-horse power gas engine, of the "Otto" type, belted to a counter shaft and thence to an "Excelsior" dynamo of the Churchwood Four Pole type. A countershaft was used so that a dynamometer could measure the power delivered to the dynamo.

Description of Engine.—The valves of the engine are both positive in action, being actuated by levers which receive their motion at the proper time, by means of cams. These cams are keyed to a shaft at right angles to the main shaft and receiving its motion by means of gears of the "worm and wheel" type.

The air is taken from the base of the engine, thus muffling the sucking noise; while the gas is governed by a small valve worked at the proper time by the governor.

The governor is of the "pendulum" type; its method of operating being such that if the speed of the engine is too great the "toe" of the governor is lifted, thus missing the gas valve and preventing an explosion until the engine has resumed its proper speed. The ignition is "hot tube." The exhaust is first expanded into a large iron pot and then passes into the air.

The dynamo is a four-pole compound wound machine with carbon brushes, which feed perpendicular to the surface of the commutator, thus insuring the constancy of the "neutral" point. The "mains" lead from the dynamo to the "bus-bars" of a marble switchboard, being controlled by a double knife switch. From the "bus-bars," mains, controlled by a double knife switch, lead to 10 pull-switches, each controlling 10 lights. The "lights" are banked on a swinging board in the window and there is also a "pilot" light, across the brushes of the dynamo. Each of the two main circuits and of the ten small circuits is protected by fuses. A Weston ammeter is on circuit from the dynamo and a Weston voltmeter is across the "bus-bars." The shunt field of the dynamo is controlled by a rheostat on a switchboard.

Indicators.—The indicators are the new form Tabor, the spring 207 pounds, as connected by a Crosby testing set. For a reducing motion a "Bromble" pulley was used.

The "explosion" recorder designed and built by the writers will be very easily understood by reference to the cut. It is simply an indicator, whose piston area is one-quarter of a square inch, to reduce the shock of the explosion which moves the figures or dials of a revolution counter instead of a pencil. The electrical instruments are the Weston standard, and were accurately standardized at the electrical laboratory of the Institute.

The Tables.—The following tests contain the data taken at the engine; the averages for each test, and a table of comparison of costs at different loads.

Test I.

No. of Card.	Rev. of Engine.	Explosions.	Gas Meter.	Volts.	Amperes.	No. of Lights.	Revolutions. Dynamo.	Revolutions. Countershaft.
1	280	434,533	9,620	115	9.5	21	1,280	498
2	284	.....	....	112	9.1	21	1,300	510
3	280	.....	....	108	9.0	21	1,320	520
4	280	.....	....	110	9.5	21	1,355	508
5	280	.....	....	115	9.0	21	1,390	512
6	280	.....	....	112	9.0	21	1,336	510
7	276	.....	....	112	8.8	21	1,338	500
8	280	.....	....	109	8.5	21	1,324	520
9	272	.....	....	108	8.5	21	1,320	500
10	280	.....	....	107	9.0	21	1,320	500
11	272	.....	....	110	8.5	21	1,360	520
12	270	.....	....	108	8.8	21	1,300	500
13	264	.....	....	109	8.6	21	1,332	500
14	268	.....	....	109	8.5	21	1,294	498
15	268	.....	....	107	8.5	21	1,340	500
16	272	.....	....	107	8.4	21	1,298	490
17	264	450,619	10,163	106	8.8	21	1,260	490

Ignition tube requires 4 cubic feet of gas per hour,
Spring used, 207 lbs.
Bore of cylinder, 7 inches. Stroke, 18 inches.

1. Abstract of Thesis, submitted by authors before the Stevens Institute of Technology, June, 1896.

TEST 1.—*Calculations.*

Revolutions per minute	274.7
Explosions (total)	16,066.0
" per minute	66.94
Gas (total)	643. feet.
" used by engine = 543 — 4 × 4	527. "
" per hour 527 ÷ 4	131.75 "
" " indicated horse power	22.6 "
Volts	109.6
Amperes	8.8
Watts = 109.6 × 8.8	964.48
Electrical H.P. = $\frac{964.48}{746}$	1.29
M.E.P	68.79
Initial pressure, average	249.4 lbs. abs.
" highest	366.6 "
" lowest	165.8 "
I.H.P. = $\frac{13 \times 38.48 \times 66.94 \times 68.79}{12 \times 33{,}000}$	5.82 I.H.P.
Cost per hour, gas costing $1.25 per 1,000 cubic feet $\frac{131.75}{1{,}000} \times 1.25$	$0.165
Cost per lamp hour $\frac{\$0.165}{21}$	0.78

Test II.

The following set of readings were taken at intervals of 15 minutes, from 8.45 A.M. to 11.45 A.M.:

No. of Card.	Rev. of Engine.	Explosions.	Gas Meter.	Volts	Amperes.	No. of Lights.	Revolutions Dynamo.	Revolutions Countershaft.
1	256	382,650	11,561	108.0	36.0	81	....	....
2	240	384,470	....	106.0	35.5	..	....	....
3	248	386,170	....	106.0	35.5	..	....	....
4	248	.....	....	106.0	35.5	..	....	....
5	254	.....	....	107.0	37.0	..	....	....
6	254	.....	....	108.0	37.5	..	....	....
7	254	.....	....	108.0	37.5	..	....	....
8	256	.....	....	110.0	38.0	..	....	....
9	254	.....	....	108.0	37.0	..	....	....
10	264	.....	....	112.0	39.0	..	....	....
11	264	.....	....	111.0	38.5	..	....	....
12	268	.....	....	110.0	38.0	..	....	....
13	268	12,146	....	112.0	38.5	..	....	....
Avg.	256	585	....	108.6	37.2	..	....	....

Remarks:

At	8.45	consumption	180.0 feet.
"	9.45	"	211.7 "
"	10.15	"	196.5 "
"	10.50	"	196.7 "
"	11.30	"	181.8 "
"	11.45	"	182.8 "

Calculations of Test II.

Revolutions per minute	256.
Explosions (total) $\frac{(256-4)}{2} \times 180$	22,320.
" per minute	124.
Gas (total)	585.
" used by engine, 585 — 4 × 3	573.
" per hour $\frac{573}{3}$	191.
" " per I.H.P.	18.51
Volts	108.6
Amperes	37.2
Watts—108.6 × 37.2	4,039.92
Electrical H.P. = $\frac{4{,}039.92}{746}$	5.41
M.E.P	65.91 lbs.
Initial pressure, average	277.53 lbs. abs.
" highest	314.85 "
" lowest	186.51 "
I.H.P. = $\frac{13 \times 38.48 \times 124 \times 65.91}{12 \times 33{,}000}$	10.32
Cost per hour at $1.25 per 1,000 cubic feet, $\frac{191}{1{,}000} \times 1.25$	$0.239
Cost per lamp per hour	0.29

Test III.

The following set of readings were taken at intervals of 15 minutes, from 5.10 P.M. to 7.10 P.M.:

No. of Card.	Rev. of Engine.	Explosions.	Gas Meter.	Volts.	Amperes.	No. of Lights.	Revolutions Dynamo.	Revolutions Countershaft.
1	252.0	394,506	13,505	108.0	41.0	91	1,320.0	469.0
2	256.0	.....	....	102.0	43.0	101	1,290.0	478.0
3	250.0	.....	....	104.0	41.0	96	1,320.0	475.0
4	254.0	.....	....	105.0	41.5	96	1,360.0	475.0
5	250.0	.....	....	106.0	41.0	91	1,355 0	476.0
6	250.0	.....	....	103.0	40.0	91	1,350.0	473.0
7	248.0	.....	....	102.0	38.0	86	1,350.0	473.0
8	250.0	.....	....	100.0	34.3	71	1,365.0	470.0
9	250.0	408,619	13,903	104.0	32.0	71	1,360.0	470.0
Avg.	251.1	14,113	398	103.7	39.5	88	1,341.1	472.2

Remarks—Fluctuation of 1.5 volts:

At	5.40	gas used	189.3 feet.
"	6.00	"	189.3 "
"	6.15	"	190.0 "
"	6.30	"	193.5 "
"	6.50	"	195.6 "

Calculations of Test III.

Revolutions per minute	251.1
Explosions (total)	14,113.
" per minute	117.6
Gas (total)	398. cu. feet.
" used by engine, 398 — 2 × 4	390. "
" used per hour = $\frac{390}{2}$	195. "
" used per hour per I.H.P	20.28 "
Volts	103.7
Amperes	39.5
Watts	4,096.15
Electrical H.P. = $\frac{4{,}096.15}{746}$	5.49
M.E.P	64.67 lbs.
Initial pressure, average	293.69 lbs. abs.
" " highest	308.64 "
" " lowest	283.80 "
I.H.P. = $\frac{13 \times 38.48 \times 117.6 \times 64.67}{12 \times 33{,}000}$	9.61
Cost per hour at $1.25 per 1,000 feet $\frac{195}{1{,}000} \times 1.25$	$0.244
Cost per lamp per hour $\frac{.244}{88}$	0.277

Prony Brake Test.

Time P.M.	No. of Card.	Rev. of Engine.	Explosions.	Gas.	Weight on Scales.
1.25	1	260	388,881	13,170	250 lbs.
1.30	2	272	.....	.....	256
1.35	3	256	.....	.....	250
1.40	4	256	.....	.....	300
1.45	5	256	.....	.....	250
1.50	6	272	.....	.....	300
1.55	7	264	.....	.....	300
2.00	8	272	.....	.....	300
2.05	9	264	.....	.....	300
2.10	10	240	.....	.....	300
2.15	11	264	.....	13,355	300
2.20	12	264	394,505	.....	300
Average.	..	258.3	5,624	185	283.8

Remarks: Initial weight on scales = 45 lbs.

Calculations of Prony Brake Test.

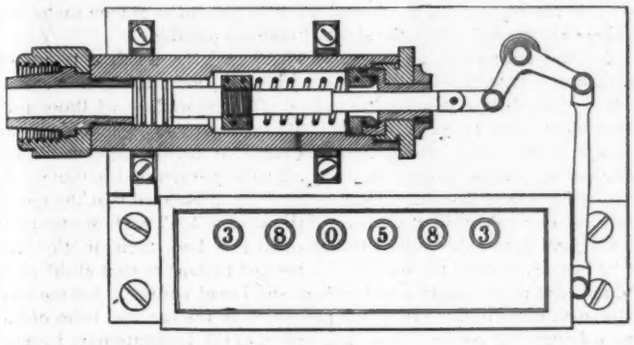
Revolutions per minute	258.3
Explosions (total)	5,624.
" per minute	102.26
Gas (total)	185. cu. feet.
" used by engine, 185 — 4 × $\frac{55}{60}$	181.34 "
" used per hour	197. "
" used per hour per I.H.P	22.69
M.E.P	67.19 lbs.
Initial pressure, average	302.94 lbs. abs.
" " highest	333.48 "
" " lowest	281.73 "
I.H.P. = $\frac{13 \times 38.48 \times 102.26 \times 67.19}{12 \times 33{,}000}$	8.68 "

Prony Brake H.P.

Diameter of pulley	16″
Circumference of pulley	4.188′
Weight on scales, average	283.83 lbs.
" " initial	45. "
" " final	238.83 "

$$\text{P.B. H.P.} = \frac{4.188 \times 258.3 \times 238.83}{33{,}000} \ldots\ldots 7.8$$

From the foregoing data it will be seen that for private houses, summer hotels and other isolated plants a gas engine is a very convenient and economical source of power for electric lighting. To obtain a light of 16-candle power, by burning the gas in the usual way, requires 5 cubic feet of gas per hour. Taking the cost of the gas at $1.25 per 1,000 feet, a 16-candle power light would cost 0.625 cent per hour. Under a very light load the plant is more costly than by burning the gas directly; but as the load increases the cost diminishes, so that at full load it is far cheaper, in this plant, to use the gas in an engine to generate the electric light than to burn the gas for light.



By using producer gas, which can be furnished at 75 cents per 1,000 cubic feet, the cost is correspondingly reduced. At that rate, in Test II., instead of the cost of a lamp hour being .29 cent, it would be .17 cent.

There are a few small expenses for oil, waste, etc., that will somewhat increase the cost, but all conditions considered, the production of the light by a plant of this kind is more economical than the direct consumption of the gas in burners.

Safeguards against Danger from Mine Gases and Falls of Coal and Roof.

[A paper read by Mr. WILLIAM JENKINS, Mine Inspector, before the Western Pennsylvania Central Mining Institute.]

There has been no question more repeatedly written upon in late years than the question of how to avoid or reduce accidents in mines, and still the same question confront us. The coal mining industry of this State very largely contributes towards its wealth, and it may be rightfully considered as the great lever by which all the other industries are moved. As to how the millions of tons of coal from our bituminous mines can be procured with the least possible loss of life or limb, when I look back over 40 years and compare the present system of mining and mine appliances with that period, I notice a wonderful change. We have a more permanent construction of shaft, slope and drift openings; a better system of transportation, ventilation, and drainage, and an improved system of mining. Headings are driven double, larger pillars are left to support the superincumbent strata so as to prevent sudden falls of roof and creeps, which sometimes cause loss of life and serious personal injuries. We have a mining law which is mandatory in its construction, and is considered by mining critics as one of the best laws in existence, and I believe it has been instrumental in preventing many accidents since its enactment. The system of ventilation and the method of distribution have wonderfully improved. We have in some of our mines nearly 200,000 cubic feet of air in circulation where we formerly had scarcely any. The method of mining is conducted on an improved system. The miners are surrounded with all the safety appliances, posts, cap pieces, and other material are furnished and placed in the working places so as to be at hand whenever needed. The law and mine rules are specific in their demands, so it was thought that everything possible had been done to protect the lives and limbs of the miners. Still the goal which the framers of the law had set has not yet been reached. One reason that may be given is that we have to go deeper for the coal, thus increasing the danger. Nearly half our miners knew nothing about mining 10 years ago. The mine workers have doubled in the last 11 years. The tonnage has more than doubled, increasing from 22,409,341 tons in 1885 to 51,813,113 tons in 1895. In 1885 we mined 311,241 tons per life lost, and in 1895 we mined 334,278 tons per life lost, showing an increase of 23,037 tons of coal mined for each fatal accident in 1895 over 1885. So we have some reason for congratulating ourselves on this head. In 1885 we had 43,471 persons employed in and about the mines, and there were 603.76 persons employed for each fatal accident. In 1895 we had 84,976 persons employed in and about the mines, and 548.23 persons employed for each fatal accident. Eliminating fractions, we have 55 persons less employed in 1895 than we have in 1885 per fatal accident. Now, gentlemen, this is food for reflection and something we should all digest well, because we are in a great measure responsible for the lives and limbs of the underground workers.

It became my duty for six years to have partial charge of a very gaseous mine where there were on an average 250 persons employed inside. We used mixed lights, as nearly all the ribs and some of the headings had to be worked with safety lamps for lighting purposes. I feel very much gratified to inform you that during those six years there were only two persons slightly burned with gas, and one person killed with slate. This last a boy was killed by the carelessness of an older person who worked with him. Now it might be interesting to know the secret of this immunity from accidents. This I am able to give you in very simple form. First, our discipline was nearly military in its exactness; when we anticipated or saw danger we did not trust to the judgment of the persons who worked there to correct it. No matter how ripe their judgment was, we were responsible for the condition of the mine, and we always felt that responsibility resting upon us. All persons were removed from places where we saw there was any danger, and the danger was removed as speedily as possible. We never waited until we were notified of our duties, but performed them at once. This is the kind of discipline that is going to save the lives and limbs of our mine workers.

Someone may be disposed to say that the dangers are now greater than they were then. This may be true, but we had the same trouble to contend with there is to-day. If there were loose coal, slate or roof, it had to be taken down or secured against falling. Posts had to be set when needed and taken out when the ribs were being drawn. There was some trouble in establishing these rules at first. Many believed that we were too exacting, but finally they concluded it was for their best interest. Many a time, in making my examination in the morning, did I take slate down and knock posts out when I discovered that the place was not safe. Try this, gentlemen, and you will be surprised at your success in reducing accidents.

Now I will, to the best of my ability, point out some of the safeguards as they appear to me. In the first place, a good fan or furnace should be provided at each colliery—a fan, I believe, would be preferable. In a gaseous mine the fan should be kept constantly in motion, forcing or exhausting a sufficient quantity of air through the mine. The mine foreman should split the air systematically, allowing from 10,000 to 12,000 cubic feet in each split; this would give him a velocity of 3 or 4 feet per second, which would be sufficient under any ordinary circumstances. This volume of air, or as much of it as was necessary, should be conducted by bratticing to the face of all narrow workings where gas is being generated so as to dilute and carry off the gas to the return airway and expel it from the mine. He should always be on the lookout, as the mine is hourly changing; he should be prompt in meeting these changing conditions, and allow no gas or any other danger to exist which it is possible for him to remove. He should not permit anyone to work in gas, nor allow anyone to brush gas out of their places. His fire bosses or assistants should be sober, conscientious and reliable men. He should never have a timeserver in his employ to fill these important positions; neither should he allow any person to examine the mine who sits late at the intoxicating cup in the evening. Many a poor fellow has been swept to the grave on account of the fire boss going to examine the mine in a dazed condition. When a fire boss neglects his duty he should be summarily dismissed and not allowed to examine another mine, because human life is too valuable to be trusted in the hands of drunken and incompetent men. The mine foreman having charge of the whole mine should know the condition of every working place each day, and see that the doors, stoppings and brattices are kept up so as to conduct the air to the face. He should see that every detail is promptly attended to if he wants to keep his mine in a safe condition. This is where many of the mistakes are made. Many

have no system in doing their work. Remember that it is not the amount of knowledge that we possess, but the knowledge that we put into practical use is what keeps a mine in a safe and healthful condition. Wherever doors are in use, a trapper boy should be provided for them, and these doors should not stand open for a longer period than is necessary for a trip or person to pass through. A better plan would be to have a split system with overcasts, thus doing away with the doors. This would provide a constant air current without any interruption, dividing the volume of air into several distinct currents. If an explosion should happen under these favorable conditions in all probability it would not be very disastrous. I would advise the use of the latest and most improved safety lamps. These lamps should give a good light and be kept locked that no person can open them until they come back to the lighting station. The lamps should be taken apart by a competent person, examined, put together, and delivered locked and in a safe condition to the parties who are going to use them.

Another danger is the occasional escape into the workings of chokedamp or carbonic acid gas from goaves or other places. The only means of guarding against this danger is to have a constant and careful inspection of the localities liable to be invaded by escapes of this poisonous gas, the presence of which can be indicated by its effect upon the flame of a lamp before it can exert its death action. To maintain a large volume of air in localities where this gas is generated and sweep it out of the mine is the only preventive against its death-dealing effects. The same might be said of white damp and other mine gases.

As to the best methods of dealing with firedamp, experts differ on this question. It is well known that this gas is generated in large volumes from the upper strata when the ribs are being taken out, leaving large cavities where it lodges and becomes a very difficult thing to dislodge and sweep out of the mine. There is nothing more dangerous in a mine than large accumulations of firedamp on top of the falls and in old goaves, and every possible means at our command should be used to expel it from there. It seems to me that this coal dust theory is too apt to carry us away, and we sometimes attributed explosions to coal dust alone, but if the fact were known the goaves were allowed to fill up to an alarming condition with firedamp, and no attention was given to them until a disastrous explosion swept through the mine; then we commence to open our eyes and wonder how this could happen. We have thick seams of coal where 7 or 8 feet of the coal is mined away, and there is nothing left to fill up its place. The roof is crushed down in large masses, and it is in those cavities and broken roof that firedamp lodges in dangerous quantities. These arched cavities are long closing up, and they form gas holding goaves, sometimes acres in extent, and sometimes communicating with all parts of the mine. These goaves should receive our special attention. No shot firing should be allowed near them. They should be closely watched. There is no use in our stopping to theorize on this important question, but get right to work and dislodge the gas and sweep it out of the mine. A large volume of air should be forced over the falls at night when the men are all out of the mine except those who have charge of this work. If this were done systematically, and then a constant volume of air was kept sweeping the edges of these falls at all times, I don't think we would have much reason to apprehend danger.

The public generally hold the superintendents, mine officials and mine inspectors responsible for nearly all the accidents in and about the mines. This is hardly fair, as the investigation shows conclusively that the victims themselves are responsible for a very large majority of these accidents. Seventy-eight per cent. of the fatal accidents in my district were traced to carelessness on the part of the victims. Some of the other districts place it as high as 80 per cent. The same can be said of the non-fatal accidents; 45.5 per cent. of the total number of deaths during the 11 years have been caused by falls of slate and roof, and 20.7 per cent. of the total deaths have been caused by falls of coal.

Now the question comes up very naturally, is there any remedy to prevent these accidents? I answer emphatically, yes, and will try to point out some of the preventives. The revised bituminous mining law of 1893 states that the "operator shall employ a competent and practical inside overseer," etc.; he must have a "certificate of competency," showing that he is qualified to perform the duties of mine foreman. The law goes further and states that he must be an "experienced coal miner." Don't let us misunderstand this, gentlemen, and employ someone who knows practically nothing about mining or the dangers that surround such work. The law describes minutely his duties, one of which is to instruct every person in the mine that has been committed to his care, and there has not been a time in the history of coal mining in this country when instruction was needed more than it is to-day. One half of our miners are children, in the knowledge of the dangers that are encountered in mining. So there is certainly a grave duty devolving on the mine foreman. Now, what instruction had better be given to those persons? I would answer that question by saying that they ought to be shown how to look for slips in the slate, dislocations, and cutter in the roof; how to sound the slate roof. The mine foreman should furnish sufficient post and cap pieces, and place them near the miner; show him how and where to set them. It is very trying sometimes to visit some mines and see posts and other timber set up in every conceivable shape; sometimes as far as 9 inches from being plumb. No attention whatever is given to slips in the slate, cutters, horse-backs and clevishis in the roof. When these timbers are set, it is just as easy to set them up right as wrong, and it is very much safer for the miners themselves. They must be taught to do this work right, if accidents are to be prevented, for it is plainly seen every day that a large majority of them know nothing about it. It is seldom that you see sprags set under the coal when it is undermined, although Rule 4 says that these sprags should be set under the coal when undermining is going on, not to exceed 7 feet apart. Rule 1 specifies that "the mine foreman shall attend personally to his duties in the mine and carry out all the instructions set forth in this act, and see that the regulations prescribed for each class of workmen under his charge are carried out in the strictest manner possible."

If I understand this act and rule right, you have no time to weigh coal, dump slate, let coal down the inclines, and other innumerable jobs. Your duty is in the mine to look after the welfare of those persons committed to your charge. Be conscientious, gentlemen, as though it were your last day upon the earth, in fully doing your duties, compelling persons to obey the law and rules governing the mines. If this is fully and honestly done I am fully persuaded that the mines will lose one-half at least of their death rate. I don't see how any man could meet that widow and orphan child and look them in the face if he has contributed the least by his neglect to deprive that child of a father, that poor woman of a husband and bread winner. Let me here admonish all to enforce fully the provisions of the law and rules of the mine during the coming year, and report at the Institute next December. I confidently believe that the report will be very flattering, fatalities will be reduced one-half, and the same will be said of personal injuries. We must not hesitate a moment in enforcing the laws.

The following is a statement of proportions of deaths from explosions in coal mines from falls of slate, roof, coal, and from other causes, and the total deaths in mines from all causes, during the years 1885–1895:

Year.	Total Number of Deaths from Accidents of all Kinds.	Explosions of Firedamp.	Falls of Slate and Roof.	Falls of Coal.	Other Miscellaneous Causes.
1885.....	72	1	61	2	8
1886.....	74	6	38	13	17
1887.....	84	5	30	27	22
1888.....	99	1	40	18	30
1889.....	39	6	41	32	20
1890.....	146	31	59	39	17
1891.....	236	111	60	25	40
1892.....	134	0	69	32	33
1893.....	131	1	69	32	29
1894.....	123	0	62	32	29
1895.....	155	4	82	26	43
	1,343	166	611	278	288

Deaths from explosions of firedamp, 12.36 per cent. of the total deaths from all causes.

Deaths from falls of slate and roof, 45.5 per cent. of the total deaths from all causes.

Deaths from falls of coal, 20.7 per cent. of the total deaths from all causes.

Deaths from miscellaneous causes, 21.44 per cent. of the total deaths from all causes.

This table, which has been compiled from the annual reports of the Mine Inspectors for the years 1885 to 1895 inclusive, gives the total number of deaths due, in each of those years, to explosions, to falls of slate and roof, to falls of coal, and to other causes classed together as miscellaneous. It will be seen that the proportion of deaths from explosions, in the total number of deaths during these 11 years, there is only 12.36 per cent. from explosions of firedamp. The mortality due to this single cause exhibits considerable fluctuations. Six lives were lost at Uniondale Mine in 1876, 31 at Hill Farm in 1890, and 109 at Mammoth Mine in 1891. With the exception of these disasters from explosions of firedamp, we have been very fortunate from explosions, not having quite 1 per cent. of the death rate from this single cause.

In order to ascertain the best safeguards against the dangerous effects of mine gases, I might first inquire why these mine gases are allowed to become dangerous. Then I might be able to point out some of the remedies that should be used to reduce them to a minimum. My first trying experience with firedamp was when 19 lives were sacrificed and I came within a hair breadth of losing my own. I was but a boy at that time, but I was old and sharp enough to know that the explosion was caused by the fire boss neglecting his duty in not bratticing the headings and rooms so that he could conduct the air to the faces, and sweep the gas out. In another instance that came under my observation two lives were lost by the fan engineer going to sleep and the fan to stop for a time, then starting it a short time before the miners went down the shaft, and not as much as warning themselves of their danger. Drivers have been known to leave doors open and cause explosions. Miners have walked over falls with naked lights in their hands or on their heads and caused explosions. Mine bosses have been known to turn air on a body of firedamp, and then go through a door to the return air way with a naked light and cause an explosion. Miners have been known to act as their own fire bosses and without taking time to examine their places have rushed headlong to their death. Fire bosses have been known to lead parties of men into old abandoned workings with naked lights without first taking the precaution to examine them. A little commonsense, I believe, should teach them better.

Photometric Value of Various Illuminants Employed in the Lighting of Mines.

[From a paper read before the Federated Institution of Mining Engineers, England, by Mr. A. H. STOKES, M.I.]

The object of the writer in making the experiments recorded in this paper was to determine the relative amount of light obtained from the illuminants used in mines, to define their economical value, to point out certain adjuncts used for increasing their lights, and to call attention to defects and dangers which occasionally accompany their use.

Experiments were made to ascertain the light intensity of safety lamps and candles, when compared with a standard candle; safety lamps and candles have also been compared with each other, and their relative light-giving intensities ascertained.

Before describing the experiments, the writer will specify the various details of the arrangements and manipulations, so that the conditions under which the experiments were made can be fully understood.

Photometer.—The photometer at the South Normanton gas works, erected in accordance with statutory requirements for the purpose of testing the illuminating power of lighting gas, was used in all of the experiments. This photometer is of the Bunsen type, is erected in a dark room, and consists of a horizontal graduated bar carrying a disc-box, and a pointer made to slide thereon. Inside the disc-box is a thin paper diaphragm, which can be moved at right angles to the plane of the graduated bar. The paper diaphragm was greased on the whole of its surface, except upon the area of a circle 1½ inches in diameter at the center.

The light to be tested was placed at one end of the graduated bar with the standard light at the opposite end, both at equal distances from the center of the bar. The center of the two lights and the center of the circular area of ungreased paper in the disc-box were placed in line and parallel with the graduated bar. The disc-box was then moved along the bar until the spot on the greased disc was nearly invisible, or both sides were equally illuminated. The pointer on the disc box then indicated upon the graduated bar the relative intensity of the two lights, the principle upon which the photometer depends being that light varies in intensity inversely as the square of the distance from the source of illumination.

Standard of Light.—The light given by a well-trimmed modern safety lamp has frequently been stated to be equal to 0.75 of the light given by a standard sperm candle, but the value of such a light compared with a candle similar to those used in mines does not appear to have been ascertained.

A miner's candle varies in size, from 24 to 16 to the pound, and burns at varying rates; equally, a safety lamp is not a standard of light, for the construction and the material burnt influence the amount of light. It was therefore necessary that a recognized standard of light should form the basis of comparison.

Standard Candle.—The standard of light used by gas engineers and which is also the statutory standard of illuminating value, is a sperm candle (6 to the pound), burning at the rate of 120 grains per hour. The consumption of sperm is accelerated or retarded by varying conditions. A delicate balance is used for weighing the candle before and after each experiment, so that the precise quantity of sperm burnt during a given period of time may be correctly ascertained, and the intensity of illumination reduced or increased, as the case may require, to bring the test to the standard of light obtained by burning 120 grains of sperm per hour.

Safety Lamp.—The safety lamp used was an ordinary miner's safety lamp. In some of the tests the lamp had only one gauze and then, theoretically, it was a bonneted Clanny; and in other tests it had two gauzes, and then assumed the Marsaut type. In some of the tests the lamp had a clear glass, and in other tests one third of the surface of the glass was enameled white to act as a reflector. The same lamp-top was used in all the experiments, and all of the parts being interchangeable, there was no difficulty in arranging for a number of oil vessels being filled with oils and otherwise prepared ready for use; the delay which would have otherwise occurred had only one oil-vessel been available was thus avoided. Each oil vessel was trimmed with 3 inches of dried lamp wick, inserted in a corrugated wick-burner.

Oil.—The names of the oils used as illuminants are stated in the tables of experiments, but the maker's names are, for obvious reasons, omitted.

Many descriptions of oil are sold for use in safety lamps; some of them being designated by a compound name of a most misleading nature. In some, the name of a seed oil, with a Latin suffix, indicating a vegetable extraction, is used, while as a fact it is a low flashing mineral oil. It would be preferable if such oils were known by their maker's name, rather than a name which gives no information whatever concerning their nature and properties, and the user would then be less likely to be misled. Colza and rape oils are not always of uniform quality, and frequently vary both in price and illuminating power. "Colza" oil is a vegetable oil like that extracted from the olive, and "rape" oil is a vegetable oil extracted from the rape seed.

Candles.—In the experiments, two descriptions of candles were used, viz., common tallow and wax composite. In the first, the wick consisted of a number of cotton threads, and in the wax composite the wick was prepared and plaited. The cotton wick of tallow candles requires frequent snuffing if burning in a still atmosphere, but when used in a mine with a good current of ventilation the snuff does not accumulate to any great extent. The tallow candles used were kept snuffed and burning at their brightest. The plaited wick of the composite wax candle burns away without serious deterioration of the light and seldom requires snuffing.

The experiments were made under the following conditions: Various oil merchants were applied to for samples of safety lamp and other oils, and samples were also obtained from various colleries using safety lamps. A number of clean oil vessels were charged with the different oils to be tested, and were trimmed by a colliery lamp man. Before commencing the experiments all the wicks were lighted and allowed to burn until the oil vessel became warm, so that the oil might be burnt at a temperature as near as possible to what it would be when in use in a mine.

The lamp top was also warmed before commencing the experiments, so that the conditions might be similar with respect to ingress and egress of the air-feed for the flame.

Immediately before an experiment was made, the wick was snuffed clean, the oil vessel was screwed into the lamp, and the light adjusted by two experts in the use of lamps, who sought to obtain the maximum amount of light without smoke.

The safety lamp or candle, after having its light adjusted, was taken into the photometer room (dark room) and its photometric power ascertained by three persons, each making a separate test.

There appeared to be two causes for a low illuminating power: (1) Two gauzes are detrimental to the free ingress of air to feed the flame, and they impede the egress of the products of combustion; (2) The clear glass cylinder around the flame allows the light to radiate in all directions.

Having found by the first series of experiments that two gauzes and a clear glass surrounding the flame did not either conduce to the free-burning of the light or concentrate the light, the second series was made with the same safety lamp, but having only one gauze and a lamp glass having one-third of its internal surface enameled white so as to form a reflector at the back of the light.

The second series of experiments very clearly shows the advantage of free ingress of air to the flame, and equally free egress for the products of combustion. The experiments also show the value of a white reflector, and the increased light which may be obtained in a forward direction by using a white background to concentrate and focus the

light in a given line. In some cases the light was more than double that given by the same oil and wick in the first series of experiments.

Safety Lamps.—Some safety lamps give better photometric results than others, and certain conditions of construction appear to be essential so as to obtain a good light. Safety lamps which afford an easy ingress of air direct to the flame, and a free egress for the products of combustion, give the best light, as it is requisite that the flame should have an unlimited supply of oxygen, and that the resultant gases should be rapidly carried away.

The extra gauze in the Marsaut type of safety lamp materially increases its safety, but it retards the ingress of air and the egress of the products of combustion. Some lamps admit air at the bottom, but the area of the inlets is considerably reduced by the covering of gauze, and it is probably owing to the reduced area of the inlets that they do not appear to burn better than lamps of the single gauze type, where the ingress air passes through the gauze and downwards to the flame.

The construction of the modern safety lamp is not calculated to give free ingress and egress for the air, and the value of free access of air to the flame can easily be seen by burning the light with the lamp bottom uncovered and free to the atmosphere, and then placing over it the lamp glass and gauze.

Wick.—The wick should be well dried before being used, and provided that it touches the bottom of the oil vessel, the shorter it is the better, having due regard for its economical use. To obtain a good light, it is better to have a short wick frequently renewed than a long wick burning for a considerable period.

Trimming.—The trimming of the oil vessel of a safety lamp is a matter of greater importance than appears to be generally acknowledged. It is often done by boys, and frequently in a rough and careless manner.

The filling of the oil vessel requires no skill, but the renewal of the wick, the proper fitting of the same to its holder, and the cutting of the wick so that the full width of flame may be obtained are matters upon which the amount of light and free burning flame largely depend. The cutting or trimming of a wick appears to be a very trivial matter, but many trivial points when carefully attended increase the value and usefulness of the light. A flat wick cut irregularly gives a poor light compared with the same wick cut straight across. In the first case a smoky spiral flame with little light is the result, in the latter a broad light-giving flame is obtained.

Moisture is detrimental to the free burning and travel of the oil through the wick, and therefore proper provision should be made in the lamp room for storing ready cut lengths of wick in a dry condition.

The wick should be flat, about ½-inch wide, and should consist of loosely plaited cotton threads. It should be slightly wider than the wick tube, so that when saturated with oil it will be self-supporting. It must not fit so tightly that the free flow of oil through it by capillary attraction is prevented.

Lamp wicks may become reduced in their freeness to capillary or feeding action by solid matter in the oil being deposited in the wick during the passage of the oil to the flame. This points to the advisability of frequent renewal of the wick.

The construction or plaiting of the wick should be arranged so that, although forming a fairly solid body, it should not be so close as to prevent capillary attraction.

Wick Tube.—The wick tube for a flat wick should be corrugated on one side, and be only slightly less in width than the wick to be used in it.

Some wicks when lighted soon become caked with a crust of burnt wick, this defect in many cases being due to the form or size of wick tube.

The tube should be a medium for holding the wick in its proper position, and of permitting the flame, by capillary attraction, to draw an unlimited supply of oil to it. A corrugated tube has been found to be the best form. It not only permits of a free supply of oil, but, to a large extent, it prevents incrustation, and a more uniform and better light is obtained.

The trimming slot in the side of the wick tube is frequently too large; in some cases it is so large that when a light oil is used inflammable vapors escape from it and fire at the flame of the lamp. The slot should be no longer than is necessary to allow the pricker to freely adjust the height of the wick.

The top of the wick tube, when the lamp bottom is screwed up, should be about ¼ inch above the bottom sight line of the lamp glass. The tubes in many lamps now in use are placed too high, diminished light being the result.

Pricker.—The pricker is a very simple, but, at the same time, an important part of a lamp. Many users of lamps cannot cleanly snuff the wick of a locked lamp and retain the light. This is in some measure due to bad manipulation, but it is also due to an awkward form of pricker. The present style of pricker permits of only half the wick being snuffed, the other half being usually removed by a blow of the hand upon the oil vessel, or by knocking the lamp against some hard substance.

The pricker should be of a form that will reach across the full width of the wick tube. It should not act parallel to the wick tube, as that mode of action would frequently extinguish the light. It should cut across the top by commencing to take the snuff off at one end of the wick, and allow the flame to relight the snuffed part before cutting away the snuff from the opposite end.

The pricker should work easily, but sufficiently tight so as to remain in any position in which it may be placed, and it should be long enough to allow of its being placed, when out of use, so that it will not interfere with the flame.

It is surprising to find how large is the number of defective prickers in use. Considering that this is the only means which the workmen have of snuffing or manipulating the flame, it is important that the pricker should always be in good working order. Far more attention should be bestowed upon this small part of a safety lamp than is now given to it.

Glass.—Nearly all the safety lamps now in use have the light surrounded by a glass cylinder. The glass should be clear, free from flaws and properly annealed. About 2½ inches of the circumference and the full depth of the glass should have a white enameled surface to form a reflector. In the absence of enameled glass, a piece of white paper or tin placed between the glass and the brass standards of the lamp will answer the same purpose, or a portion of the glass may be painted on the outside with white enameled paint.

Workmen when holing frequently use white paper reflectors for concentrating light, and they also find such reflectors convenient for shading the eyes from the direct light of the flame.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, January 10th, 1897.

Personal.—Coke and the Motor Cars.—Some Figures Respecting the Business of the Gas Light and Coke Company.—Some Features of the Past Year.

It was with great regret that I read between those ominous black lines the paragraph recording the decease of the late Editor of the AMERICAN GAS LIGHT JOURNAL. Although we had never exchanged a word in person, our business relations in connection with this monthly letter have extended over more than 12 years. It was in March, 1884, that I first had the honor of addressing (on paper) an American audience, and have continued to do so without a single miss, to the present time. The postal authorities have punctually delivered, month by month, about 150 English letters to our late friend, a fact which illustrates the method and regularity of our ocean-going postal service. In connection with these, as well as other matters, I was always treated with courtesy and kindliness, and cannot refrain from expressing sorrow at the cutting short of such a pleasant intercourse by the iron hand of death. My recollections of Mr. Jos. R. Thomas are without exception of a pleasing character, and will not pass away while memory remains.

No modern craze has excited more popular attention than the new motor car, and it is interesting to notice that amongst the numerous agencies applied as the source of motive power, compressed coal gas, and coke, are both taking a good position and are amongst the most practical of the various plans proposed. A mechanical road car is not such a new idea as many suppose. Steam omnibuses were running in London 60 years ago. and it is more than 100 years back since the inventor of coal gas alarmed the superstitious Cornish folk by traversing the roads at night with a steam road car, brilliantly lighted by means of coal gas generated from an iron retort inserted in the boiler furnace. Coal gas is in regular use on tram lines, and proves both reliable and economical, and in the course of a paper on Road Motors, recently read before the Society of Arts, the author referred to the Serpollet system as used in France, and amongst other points urged the fact that it required coke for fuel as an objection. This led the chairman of the meeting—Sir Fredk. Bramwell—to remark that he did not know what objections could be raised against coke if properly used. All fuels gave off carbonic acid if completely burned, and carbonic oxide if the combustion was not complete, and he did not know that coke gave off any-

thing else. Another speaker, Mr. Sennett, had ridden 30 miles that day on a road car, using coke as fuel, and said that coke was cleaner and simpler in application than petroleum. It could almost be claimed to be automatic in its action, as a reserve supply was carried in a hopper and shaken down into the furnace as required by the motion of the carriage without attention from the driver. The 30 miles run to which he referred was accomplished by the consumption of less than one sack of coke. When so much is heard about the difficulties attending the use of petroleum—I met a friend the other day, driving a petroleum motor, and he did not care to stop the engine, because of the difficulty he had in getting it to start—the evidence given by Mr. Sennett is notable. The advantages of a fuel that will not waste by leakage or evaporation, is not in any sense explosive or volatile, does not soil the hands or clothes, and practically falls by its own weight into the furnace as required, do not need further recommendation. Since a sack of coke is sufficient for 30 to 40-mile runs, a large supply of the fuel need not be carried, as in the most sparsely populated parts of the country it would scarcely be possible to run 30 miles without passing a gas works, so the traveler could depend on being able to get a supply of fuel each day as he required it.

The large extent of business done by gas companies has attracted the attention of persons interested in electric lighting, and the *Electrician* has lately published a few particulars showing the magnitude of the operations conducted by the Gas Light and Coke Company. This concern supplies more than 250,000 customers, and has let out or sold 114,000 gas stoves. It employs over 10,000 men, and the heaviest day's output is 128 million cubic feet of gas, for the production of which over 12,000 tons of coal (assuming the whole quantity to be coal gas) would be carbonized. The gasholder capacity is 115 million, and the loss by leakage, otherwise known as "unaccounted-for" gas, is only a fraction over 5 per cent. These statistics are of a somewhat meager character. It would be interesting to know how much of the 128 million consisted of water gas, and how far this new method has influenced the policy of the directors in regard to the matter of storage. There was a time when it would not have been deemed safe, on account of the heavy demands in foggy weather, to work with a storage capacity less than the maximum day's consumption. But according to this authority the proportion is now under 90 per cent, which rather seems to suggest two alternatives to all who find their storage capacity to be getting strained. They can either increase it or put down a water gas plant. Then the area of the district supplied, the population and the aggregate length of the main and service pipes, would convey a better idea of the extent of the business than the mere quantity of gas. A word might also have been said as to the residuals. A maximum of 12,000 tons of coal per day means about 2,400,000 tons of coal per annum. And this would represent 1,200,000 to 1,400,000 tons of coke for sale, 500,000 tons of tar and 25,000 tons of sulphate of ammonia.

The year that has just closed is notable, so far as the gas industry is concerned, for the activity exhibited in the application of the slot meter, for the same as regards the incandescent light, and for the attention that has been devoted to "acetylene." With regard to the last named the researches of investigators have been unfortunately attended with several fatal accidents, showing that any prophecies as to the practical utility of this gas are at present premature. In respect to all three matters it may be said that they have assisted in swelling the revenues for patent fees; mechanical designs for performing the "automatic" part of the prepayment operation, new materials and methods of manufacturing incandescent "mantles," and methods of generating acetylene by the addition of calcium carbide to water, have been before the authorities every day. The extraordinary demand for slot meters—which has been such as to lead in some cases to neglect of the ordinary meter trade—the marked success of the operations carried on by the Incandescent Gas Light Company, and the apparent simplicity of the means by which acetylene gas can be generated, together with its very high illuminating value, have all served to stimulate invention. So far, however, the Incandescent Company have successfully retained their control of the incandescent gas lighting business. A few attempts have been made to put other makes on the market, but so far it cannot be said that any important competitor has been established. They have had, however, the useful effect of inducing the pioneer Company to climb down very considerably in the matter of charges, and otherwise to be more attentive to customers and so forth than they were inclined to be when first starting. Many improvements in detail have been effected, and the numerous complaints as to bad mantles, greenish color of the light, etc., appear to have now been entirely remedied. A year or two ago the opinions that came to one's ears across the pay counter at the gas works were very variable. It has been a matter of amusement for some time with the rental clerks that the payment of a bill is usually accompanied by a gratuitous opinion as to the value of the incandescent light or any other new appliance that may have been tried. There used to be many complaints as to cost of mantles and inconveniences caused by their breakage, but these have now quite ceased. People begin to understand that the new system requires care and proper treatment. Acetylene can scarcely be said to have entered the region of practical politics in this country. Although so much has been said and written about it I do not hear that anything worth recording has actually been done with it. It is still more of a scientific curiosity than a practical commodity, and will probably remain so until calcium carbide becomes much cheaper than it is at present.

The year has not been without its rumors, but these have been so numerous in late years that practical men have come to look upon them almost with disgust. In these days of sensational newsmongering, any "copy" that can by clever journalistic treatment be dished up into an attractive paragraph—not one that will benefit the readers, so long as it helps to sell the paper—is published far and wide, with very little consideration as to how much of sober truth is present in it. At intervals during the last few years something or other has been announced, with a grand flourish of trumpets, as certain to supersede gas. It is now 20 years since we were told that the electric light would be turned out at a price that would put gas quite out of the field, and reduce the value of gas plant to little more than that of old iron. The remarkable impetus that would take place in the use of gas during that period was *not* foretold. But the electric light has not yet commenced to compete in any serious sense with gas. The directors of gas companies hear a great deal about it, but it is still an outside curiosity rather than a factor to be taken into account in connection with their commercial policy or practical operations. The public sympathy usually seems to be devoted to the new and untried rather than to the approved and established systems. Then a great deal of nonsense was talked about water gas, the point that if there was any advantage as compared with coal gas, the existing companies could readily avail themselves of the process, being generally overlooked. And so one could go on to illustrate how the unexpected usually happens and the prognostications of enthusiasts fall to the ground. Acetylene, for example, has been the subject of many forecasts of this kind. It has been said that the incandescent principle, as applied to coal gas, would be extended to liquid fuels and to electricity, in each case bringing about an economy in cost corresponding to that obtained in the case of gas by the incandescent burner as compared with the ordinary flat flame. Another notion that proved to be entirely unfounded was that if the incandescent light secured an economy of 50 per cent., the revenues of gas companies must suffer to a corresponding extent. The new system has been largely adopted, but the gas revenues have not suffered, for the reason, obvious to gas engineers, that the public prefer to go in for *more light* rather than for *less cost*, and that its advantages have led to its being substituted for oil, electricity and other methods of lighting. Taken on the whole, the past year has been one of encouragement to the gas industry. With the wise policy of selling gas at the cheapest possible rate, of considering the needs of the customers and using judicious means for spreading knowledge as to the numerous applications of coal gas there are excellent prospects for the future.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. John F. Parker, Receiver of the Thomasville (Ga.) Gas Works Company, under authority of an order of the Superior Court, has caused the publication of a notice announcing his determination to sell at public auction, on Tuesday, February 2d, all the properties of the named Company. For complete particulars, see our advertising columns, current issue.

A reduction at the rate of 1 per cent. per annum has been made in the dividend declared by the East Boston (Mass.) Company.

We are indebted to "S. W.," of Trenton, N. J., for the following report of the action taken by the Directors of the Gas Light Company, of the City of New Brunswick, N. J., at a special meeting convened for the purpose of adopting a minute to the memory of the Company's late Superintendent, Col. John W. Newell:

"The closing of a long and useful life is always an event worthy of notice, but where there is associated with it mutual interests and official relations covering an extended period of time, the severance of those ties becomes such that a more suitable recognition should be recorded.

"Therefore, the Board of Directors of the Gas Light Company of the

City of New Brunswick having been informed of the death of their late Superintendent, Colonel John W. Newell, on the morning of January 5, 1897, being duly convened on this 5th day of January, 1897, do unanimously

"*Resolve*, That, in the death of Col. Newell, this Company is called on to part with an officer who devoted his time and ability unreservedly to the interests over which he was placed, during a period of its history that demanded the energy, judgment and devotion which he so signally displayed during the 28 years' service with this Company.

"*Resolved*, That we tender to his family our sincere condolence and sympathy in this their hour of bereavement, and in the memories which cluster around the departed, and the sense of a Divine presence, may find consolation and support.

"*Resolved*, That we attend the funeral of the deceased, and that a copy of these resolutions be forwarded to the family, published in the city papers, and duly recorded upon the minutes of the Company.

"J. B. Kirkpatrick.
"Laffert Totten.
"S. N. D. Clark.
"Loyal T. Ives."

The proprietors of the Capital City Gas Light Company, of Des Moines, Iowa, have filed articles amendatory of their original papers of incorporation, under which the announcement is made that the capital stock has been increased to $600,000, from $300,000.

At the convention of the Circuit Court, Allegheny county, Md., on Saturday, January 9th, Judges Boyd and Sloan directing the proceedings, the case of Joseph Bear vs. The Frostburg Gas Light Company, occupied the court for the day. Complainant alleged that the Company had agreed to furnish gas to him through a meter for the purpose of lighting his storeroom. After the original contract with the Company was made, complainant contracted with the local electric light company to illuminate his premises with electric lights, which use he admitted very materially cut down his use of gas. In May, 1896, the Gas Company, finding that Bear's custom had diminished to a point where his use of gas caused him to be no longer a profitable consumer, removed the meter. This, briefly, was the pith of the testimony—plaintiff sued for $1,000 damages. The case was submitted to the jury, who found for the plaintiff, assessing his damages at 1 cent.

At the annual meeting of the Ypsilanti (Mich) Gas Company the officers chosen were: Directors, D. L. Quirk, S. H. Dodge, C. E. King and C. S. Wortley; President, D. L. Quirk; Secretary, C. S. Wortley.

The proprietors of the Chattanooga (Tenn.) Gas Light Company have announced a reduction in gas rates, to take effect from January 1st. The gross rate for an illuminating use is put at $1.40 per 1,000 cubic feet, with 10 per cent. off for prompt payment; for heating, cooking and power use, $1.40 per 1,000 cubic feet, with 35 cents off, on bills amounting to less than $25 per month, for prompt payment; on bills amounting to $25 or over per month the discount is to be 40 cents per 1,000.

The following letter explains itself:

Engineer's Office, Gas Works,
Portland, Me., January 15th, 1897.

To the Editors American Gas Light Journal: In your issue of January 11th you published a letter, from the pen of Mr. J. Bryant Grimwood, of San Francisco, Cal., in which he assumes the responsibility of advising me that I have been guilty (to his credit be it said) unintentionally of appropriating to myself the credit for devising a method for dissolving naphthaline deposits, which method was original with Mr. E. C. Jones, and to whom the credit belongs. That Mr. Jones should have such an ardent champion, and that the letter was inspired by an *attache* of the San Francisco Gas Light Company, are matters of small moment; but for fear that the inference may be drawn from Mr. Grimwood's communication that I have wilfully attempted to steal "Mr. Jones' thunder," I trust you will, in justice to myself, kindly permit me to use a portion of your valuable space in my own defence. Reference to my article will show that I stated, "Whether the method devised had ever before been employed I do not know; but feeling assured that it will be new to a number of gas superintendents, I venture to describe it." Such are the facts, for Mr. Jones' "Wrinkle" had never come under my observation until my attention was drawn to it by Mr. Grimwood; and, therefore, the method in question, so far as I am concerned, was original with me. That Mr. Jones' "Wrinkle" antedates my "Evolute" by nearly two years is a matter of record, and I have pleasure in "taking off my hat" to Mr. Jones, in the instance of *priority*. The obvious inference to be drawn from Mr. Grimwood's communication, that my sole purpose in recording my experiment was to secure credit to myself, is wholly at variance with the facts; for it is only fair for me to say that I did so entirely in a spirit of reciprocity for many an idea of value contributed by other engineers. I have no regrets over having recorded it, for, even if identical with that of Mr. Jones, it drew attention to a plan of value, and one which *was new* to a number of superintendents, as is evidenced by the fact that, before sending my article, I drew the attention of several superintendents to it, and to each it was a new idea. Had I known of the Jones "Wrinkle," I still should have recorded my experiment, but would have labeled it "An indorsement of the Jones 'Wrinkle' for preventing naphthaline stoppages.'" Very truly yours, E. H. Yorke.

We understand that the capitalists interested in the Salt Lake and Ogden (Utah) Gas and Electric Light Company are considering the advisability of purchasing the plant and franchise of the Leadville (Col.) Electric Light Company.

The Court of Appeals of Kentucky, through Judge Hazelrigg, has handed down an opinion, in an appeal by the Louisville Gas Company, from an order issued by the Louisville Chancery Court, restraining the Company from collecting meter rents, which sustains the ruling of the lower court. It had been the practice of the Company to collect a meter rental when the monthly consumption was less than 1,000 cubic feet, the charge varying from 10 to 40 cents; and Secretary Porter is authority for the statement that the Company will accept the ruling of the Court of Appeals as final.

The executive management chosen by the Board of Directors of the Peoples Gas Light Company, of Cleveland, Ohio, is appended: President, George H. Warmington; Secretary and Treasurer, J. M. Carrington; Superintendent, D. R. Warmington.

The Directors of the Northampton (Mass.) Gas Light Company have elected Mr. E. H. Banister to the position of Treasurer for the unexpired term of the late Mr. George P. Dickinson.

The proprietors of the Leominster (Mass.) Gas Light Company have ordered a reduction of 50 cents per 1,000 in the selling rate.

At the annual meeting of the Newburyport (Mass.) Gas and Electric Company the following officers were chosen: Directors, William R. Johnson, W. H. Swasey, L. B. Cushing, N. M. Jones, T. C. Simpson, E. P. Dodge and Samuel March; President, W. R. Johnson; Treasurer and Clerk, D. D. Tilton.

Articles incorporating the Sheepshead Bay Gas Light Company, to manufacture and supply gas in the Sheepshead Bay district of Brooklyn, N. Y., were filed with the Secretary of State on the 18th inst. The Directors named are Messrs. C. W. Pfarrer and Alfred Holme, of Brooklyn, N. Y., and Bruno Scheldknecht, of Hoboken, N. J. The Company is capitalized in $25,000.

At the annual meeting of the St. Paul (Minn.) Gas Light Company the officers chosen were: Directors, Emerson McMillin, Crawford Livingston, Stamford Newell, Elbert A. Young, F. W. McCutcheon and ex-Governor Merriam; President, Emerson McMillin; Vice President and Counsel, F. W. McCutcheon; Secretary, Treasurer and General Manager, B. F. Ellison; Assistant Secretary, H. B. Wilson.

At the annual meeting of the Hartford City (Conn.) Gas Light Company the officers elected were: Directors, John P. Harbison, Francis B. Cooley, James L. Howard, Henry K. Morgan, George Roberts, Atwood Callins, Nathaniel Shipman, Rodney Dennis and Hugh Harbison; President, James L. Howard; Treasurer and General Manager, John P. Harbison; Secretary, Thomas Evans.

The Milwaukee (Wis.) Gas Light Company has subscribed $5,000 to the fund for the proper observance of the semi-centennial anniversary of Milwaukee's attainment to cityhood.

We regret to report the death, on the 4th inst., of Mr. James P. Michellon, of Merchantville, N. J. Deceased was born in the Southwark district of Philadelphia, in 1825, and subsequently (1848) removed to Camden, N. J., where he became associated with Messrs. J. W. and J. F. Starr in the Camden Iron Works. In 1866, in conjunction with the late Mr. William Sexton, he started the Gloucester (N. J.) Iron

Works, which afterwards was organized as a stock company. This concern was in the seventies well known to gas men from the large trade done by it in manufacturing pipe and in constructing gasholders. Mr. Michellon was Secretary of the Company until it went into liquidation in 1891.

ACCORDING to the report submitted by the proprietors of the Louisville (Ky.) Gas Company to Mayor Todd, of Louisville, respecting the operations of the Company for the past year, the receipts for the twelvemonth were:

From sales of gas	$403,371.88
" " coke	49,999.36
" " tar	21,210.21
" " ammonia	7,066.71
" " gas fittings	46.72
Total	$481.694.88

The expenditures for the twelvemonth were:

General expenses	$146,832.36
Manufacturing account	144,501.01
Maintenance of works	18,349.82
" " mains	3,252.09
" " services	4,117.90
" " meters	10,018.08
" " street lamps	17,282.66
Coke	11,091.08
Total	$355,444.00
Net receipts from sale of gas	126,250.88
Rent to gas account from electric plant	74,456.11
Total receipts applicable to dividend	$200,706.99

The earnings amounted to 5.57 per cent. on the capital stock, which now stands at the sum of $3,600,000, of which the city holds $925,000.

THE certificate of incorporation of the Little Falls Electric Light and Power Company and the Little Falls Gas Light Company into the United Gas and Electric Companies, of Little Falls, N. Y., has been filed with the Secretary of State. The capital stock of the new Company is $90,000, and the Directors for the first year are: Capt. W. H. White and Henry C. Bush, of New York, and Nelson R. Gilbert, Elijah Reed, Thomas Bailey, Watts T. Loomis and William F. Lansing, of Little Falls.

UNDER its new charter the Company is authorized to furnish gas for illuminating, heating and power use, and electric currents for illumination and power in the city of Little Falls and in the towns of Danube and Manheim, Herkimer county, N. Y. Under the consolidation agreement shareholders in the Little Falls Electric Light and Power Company receive three shares of stock in the United Gas and Electric Companies, while the former shareholders of the Little Falls Gas Light Company receive a $75,000 first mortgage bond, secured by the entire property of the succeeding Company.

FOR the benefit of the fraternity who will attend the forthcoming gas exhibition at Madison Square Garden, we print the following list of hotels and rates—the table was originally prepared by Mr. Lathrop, Secretary of the Ohio Gas Light Association: Ashland House, 4th avenue and 24th street; room and board, $2.50 to $3 per day; room without meals, $1 or more per day. Broadway Central, Broadway, between Bleecker and 3d streets; American plan, $2.50 to $3 per day; European plan, $1 or more. Fifth Avenue Hotel, Fifth avenue and 23d street, American plan only, $4 per day. Grand Hotel, Broadway and 31st street, European plan only, $1 per day and more. Grand Union, opposite Grand Central Station, 42d street, European plan, $1 per day and more. Gilsey House, Broadway and 29th street, European plan, $2 per day and more. Holland House, Fifth avenue and 30th street, European plan, $2 per day and more. Hotel Imperial, Broadway and 32d street, European plan only, $2 per day and more. Hotel Marlborough, Broadway and 36th street, European plan, $1.50 per day and more; American plan, $3.50 per day and more. Metropolitan, Broadway and 27th street, European plan only, $1 per day and more. Murray Hill Hotel, Park avenue, 40th and 41st streets, European plan, $2 per day and more; American plan, $4 per day and more. Sturtevant House, Broadway and 30th street, European plan, $1 per day and more; American plan, $2 per day and more. St. Cloud Hotel, Broadway and 42d street, European plan, $1 per day and more; American plan, $3 to $4 per day. Windsor Hotel, Fifth avenue and 46th street, European plan, $1.50 per day and more. Union Square Hotel, Union square, east, European plan, $1 per day and more; American plan, $3 to $4 per day.

THE following letter explains itself:

PACIFIC GAS ASSOCIATION, OFFICE OF PRESIDENT,
NAPA, CAL., Jan. 9th, 1897.

To the Editors AMERICAN GAS LIGHT JOURNAL: In your issue of December 28th, 1896, page 1015, an item appears which refers to an application of a certain so-called Pacific Gas Light and Heat Company for a franchise to construct works and furnish gas in San Rafael, Cal., at a maximum rate not to exceed $2 per 1,000 cubic feet. Feeling interested in the matter of cheap gas in suburban localities, and in competition in the lighting field as well, I made the necessary inquiry, with the following results, which outcome I would like to place before the Pacific Coast fraternity. I desire to use your columns to that end, as the JOURNAL reaches all in our extensive territory. These blackmailers should be shown up. Yours fraternally, T. R. PARKER.

THE result of Mr. Parker's inquiry is here given:

SAN RAFAEL, CAL., Jan. 9, 1897.

Friend Parker: Van Syckel and Lewelling having nothing to do with this raid. The Pacific Gas Light and Fuel Company filed articles of incorporation in San Francisco, October 9, 1896. Capital stock, $500,000; cash subscribed, $600; incorporators, F. R. Bell, J. H. Lounge and R. C. Semler, of San Francisco, Elmer Reed, of Alameda, W. C. Wolfe, Los Angeles, and William Gwynn, of Napa. Messrs. Lounge and Gwynn appeared before our Board, with a local attorney, who introduced Gwynn as the attorney and Lounge as the expert of the Company. Gwynn spoke for the Company, saying they already had a franchise at Sacramento; that they wanted one here, and wanted it quick. When questioned concerning the financial standing of the Company, he said there was no stock for sale; that, in fact, they were merely agents for H. C. Rew, 218 La Salle street, Chicago, who was really the party in interest; that Mr. Rew had a very cheap process for making gas; that he was a man worth four million dollars; and that he had already established plants in Kansas City, Omaha, Davenport and Chicago. The Board welcomed the new Company, but delayed taking any action until the third Monday in January. Lounge, I discovered, was a Knight of Fortune, who posed as a meter inspector (incorporated) for a time in San Francisco; also, in Oakland and Sacramento. The inclosed clipping tells the rest. Yours, with best wishes, S. B. CUSHING.

THE clipping inclosed, which was taken from the Marin *Journal* of Jan. 7, is as follows:

"The Pacific Gas and Fuel Company referred to H. C. Rew, of Chicago, as their backer. Trustee Eickhoff wrote to him, making inquiries, and received the following reply:

"'523, No. 218 LA SALLE STREET,
CHICAGO, Dec. 26th, 1896.

"'HENRY EICKHOFF, ESQ, San Francisco: Dear Sir—I have your favor of the 22d inst. and note its contents. In reply I would say that I do not know the parties who are exploiting the Pacific Gas Light and Fuel Company, therefore nothing as to their financial standing or responsibility. Nobody on the Pacific Coast is authorized to use my name in any way, shape or manner in pushing enterprises of any kind, and I regret to hear that anybody has taken that unwarrantable liberty in connection with the enterprise you mention. Yours truly, H. C. REW.'"

Clearing Gasholder Inlet and Outlet Pipes of Naphthaline.

The London *Journal* notes that Mr. O. Peischer recently described, in the *Journal fuer Gesbeleuchtung*, a method which he has successfully employed to remove naphthaline from the inlet and outlet pipes of gasholders. Two holes are made in the crown of the holder, directly above the pipes, and large enough to allow of the insertion of a ¼-inch pipe, the lower end of which has a number of small openings, while the upper part is furnished with a tap and a funnel. When naphthaline has accumulated in the inlet or outlet, the pipe is put through the holder crown, and boiling water poured into the funnel. The action is rapid, and at the end of a quarter of an hour the obstruction will have been removed. The hole in the crown is closed with a screw plug when the pipe is not in position. It is not claimed that all the naphthaline will be got rid of. But the remedy is simple, and it can be applied as often as may be necessary.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.
TEXAS GAS AND ELECTRIC LIGHT ASSOCIATION.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

AGENTS:

York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JAN. 25, 1897.

Calcium Carbide: A New Reducing Agent.

Mr. N. H. Warren, in a recent issue of *Chemical News*, said that since the introduction of this remarkable substance it is significant that scientific men have been content to allow the product to rank solely as a water decomposer, and thus regard the production of acetylene the only available product.

Researches of a somewhat lengthy description, which have lately been carried out, involve the use of calcium carbide as a metallurgical reducing agent.

In the first instance an excess of litharge was heated to redness in contact with the carbide, in a clay crucible, the reaction being accompanied by vivid incandescence, resulting in the formation of metallic lead and calcium oxide (C O.)

A further portion was now selected, in which the proportion of carbide excelled that of the litharge; this was further subdivided into various smaller portions, each portion being exposed to various temperatures, resnlting in a regulus of calcium and lead of varying percentage, together with the expulsion of CO_2.

The alloys thus formed are all more or less brittle, and to a certain extent sonorous when struck, their melting point ranking below that of pure lead, and are slowly but completely decomposed in contact with aqueous vapor, the reaction being much less energetic than that afforded by alloys of lead with the alkaline metals. Stannic oxide, cupric oxide, and also ferric oxide, at corresponding higher temperatures, were readily reduced, yielding results of no practical value; in the case of the cupric alloys those samples containing under 1 per cent. of calcium being rendered cold-short and breaking under very small strain, whilst, on the other hand, iron containing calcium approaches in appearance that of ferro-manganese, being even more brittle and very oxidizable in contact with water.

In a further operation, oxides of manganese, nickel, cobalt, and even chromium, molybdenum and tungsten, were readily reduced, yielding calcium alloys. Results of experiments, comprising the reductive action of the carbide upon the earthy chlorides and their haloids, will be shortly to hand.

The already partial success of these reactions seems to point most conclusively towards a new and powerful reducing agent, which at the same time, considering the market value of the carbide in question, could not fail to replace both sodium and potassium.

On the Use of High Voltage Lamps.

Mr. G. L. Addenbrooke, in a recent issue of London *Electrical Engineer*, says that unless an entirely new lamp makes its appearance, the voltage of about 250 will be the limit for some time to come. With nearly 500 volts between on a 3-wire system, the limit of safety is, under present conditions, about reached. The extra precautions necessitated by going above 500 volts would go a good way toward discounting any further saving in the mains. Although no one would think of operating a lighting and railway system on the same generator, yet the use of 220-volt lamps will permit of using the same generators for both purposes, being connected to whichever service they were needed upon. He states that in many cases marked economy would be secured in this way if accumulators were used to a considerable extent in the lighting.

The Market for Gas Securities.

A better feeling prevailed in the market for city gas shares during the week, with the net result that Consolidated scored an advance of virtually 4 points. To-day (Friday) the opening was made at 147½ to 148, and there is little doubt that it will soon reach a point much nearer its intrinsic value than is expressed in the current quotations. Investors should remember that the real properties owned by the Consolidated and Mutual Companies put them in an invulnerable position, when it comes to a question of sifting out the relations that exist between the actual value of the property owned and the par value of shares issued, or that may be issued under their charters. The legislative situation in respect of the gas companies of the State shows no particular change, not that rate bills are not in plentiful evidence, nor that the newspaper patriots are not still yawping loud and long, but rather that a wish or desire for fair play seems to rule with the legislative majority. We still think that the Legislature will not pass any rate measure which will be unduly harsh, and continue to hold the belief that the ultimate outcome of the agitation will be the institution of a commission. Mutual is notably strong, at 225 bid; and Equitable is once more at the 200 mark. Other city shares are generally higher.

Brooklyn Union is 91½ to 93, and the bonds are in brisk demand at 107½ to 108. Chicago gas is 78½ to 78¾, on the knowledge that the quarterly dividend of 1½ per cent. is assured Bay State is dull, although fairly strong, and we reaffirm our belief that it is cheap at the market. Consolidated, of Baltimore, is in demand, at 62 to 62½.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

JAN. 25.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	147½	148
Central	500,000	50	195	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	200	..
Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	225	.
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	.	
Northern	150,000	50	85	..
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	43¾	44½
Preferred	2,000,000	100	78	75
Bonds 1st 5's	3,500,000	1,000	105	106
" 1st Con. 5's	1,500,000	.	94	96
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	.	
Standard	5,000,000	100	80	81½
Preferred	5,000,000	100	100	103
Bonds, 1st Mortgage, 5's	1,500,000	1,000	109½	
Yonkers	299,650	50	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	91½	93
" " Bonds (5's)	15 000,000	1,000	107½	108
Bay State	5,000,000	50	11⅝	12
" Income Bonds	2,000,000	1,000	..	35
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000		76
Buffalo Mutual	750,000	100	185	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	78	78¼
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,069,000	..	68	70
1st Mortgage	1,085,000	..	..	96
Consumers. Jersey City	2,000,000	100	70	75
" Bonds	600,000	1,000	100	102
Cincinnati G. & C. Co.	7,000,000	100	200¼	200½
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		
Consolidated, Baltimore	1,000,000	100	62	62½
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	.	22	..
" Con. Bonds	4,312,000	..	78	78½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	82	86
" Bonds	2,000,000	.	85	90
Hartford	750,000	25		145
Indianapolis	2,000,000	..	180	185
" Bonds, 6's	2,650,000	..	103	105
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind	1,000,000	100	84	88
Bonds	1,000,000	1,000	85	90
Louisville	2,570,000	50	.	..
Laclede, St. Louis	7,500,000	100	24¾	25
Preferred	2,500,000	100	71	80
Bonds	9,084,400	1,000	93½	94
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	93	98
Bonds, 6's	4,000,000	.	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105

Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87¾	90
San Francisco, Cal.	10,000,000	100	97¾	98¾
St. Paul Gas Light Co.	1,500,000	100	67¾	70
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	63	65
Bonds, 5's	3,556,000	.	90	93
Wilmington, Del.	500,000	50	180	182

Advertisers' Index.

GAS ENGINEERS.

Page

Wm. Henry White, New York City ... 155
Fred. Bredel, Milwaukee, Wis. ... 141
Geo. R. Rowland, New York City ... 155
The Western Gas Construction Co., Fort Wayne, Ind. ... 146
Humphreys & Glasgow, New York City ... 142
T. G. Lansden, St. Louis, Mo. ... 156
American Gas Co., Phila., Pa. ... 137
David Leavitt Hough, New York City ... 138

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md. ... 153
United Gas Improvement Co., Phila., Pa. ... 145
Burdett Loomis, Hartford, Conn. ... 154
National Gas and Water Co., Chicago, Ills. ... 147
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 153
The Western Gas Construction Co., Fort Wayne, Ind. ... 146

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City ... 156
Continental Iron Works, Brooklyn, N. Y. ... 154
Deily & Fowler, Phila., Pa. ... 156
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 152
Stacey Mfg. Co., Cincinnati, Ohio ... 155
Bartlett, Hayward & Co., Baltimore, Md. ... 153
Davis and Farnum Mfg. Co., Waltham, Mass. ... 152
R. D. Wood & Co., Phila., Pa. ... 154
Isbell-Porter Company, New York City ... 154
Fred. Bredel, Milwaukee, Wis. ... 141
United Gas Improvement Co., Phila., Pa. ... 145
Berlin Iron Bridge Co., East Berlin, Conn. ... 142
National Gas and Water Co., Chicago, Ills. ... 147
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 153
The Western Gas Construction Co., Fort Wayne, Ind. ... 146
Humphreys & Glasgow, New York City ... 142
Gas Engineering Co., Pittsburgh, Pa. ... 152
American Gas Co., Phila., Pa. ... 137
Logan Iron Works, Brooklyn, N. Y. ... 156
Riter & Conley, Pittsburgh, Pa. ... 136

SCRUBBERS AND CONDENSERS.

G. Shepard Page's Sons, New York City ... 155
R. D. Wood & Co., Phila., Pa. ... 154
James R. Floyd & Sons, New York City ... 156
Continental Iron Works, Brooklyn, N. Y. ... 154
Gas Engineering Co., Pittsburgh, Pa. ... 152
Logan Iron Works, Brooklyn, N. Y. ... 156
Riter & Conley, Pittsburgh, Pa. ... 136

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md. ... 153
Fred. Bredel, Milwaukee, Wis. ... 141
J. H. Gautier & Co., Jersey City, N. J. ... 150
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 150
Adam Weber New York City ... 150

TAR AND CARBONIC ACID EXTRACTOR.

G. Shepard Page's Sons, New York City ... 155
R. D. Wood & Co., Phila., Pa. ... 154

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich. ... 136
G. Shepard Page's Sons, New York City ... 155
Gas Engineering Co., Pittsburgh, Pa. ... 152

GAS METERS.

John J. Griffin & Co., Phila., Pa. ... 160
American Meter Co., New York and Philadelphia ... 159
The Goodwin Meter Co., Phila., Pa. ... 158
Helme & McIlhenny, Phila., Pa. ... 159
D. McDonald & Co., Albany, N.Y. ... 159
Nathaniel Tufts, Boston, Mass. ... 158
Maryland Meter and Mfg. Co., Baltimore, Md. ... 158
Metric Metal Co., Erie, Pa. ... 158
Keystone Meter Co., Royersford, Pa. ... 138
Buhl Stamping Company, Detroit, Mich. ... 159

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia ... 159
John J. Griffin & Co., Phila., Pa. ... 160
D. McDonald & Co., Albany, N. Y. ... 159
Helme & McIlhenny, Phila., Pa. ... 159

GAS AND WATER PIPES.

Ohio Pipe Co., Columbus, Ohio ... 157
M. J. Drummond, New York City ... 157
R. D. Wood & Co., Phila., Pa. ... 154
Warren Foundry and Machine Co., New York City ... 157
Donaldson Iron Co., Emaus, Pa. ... 157

PIPE CUTTERS.

Wm. Anderson, East Boston, Mass. ... 136

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, New York City ... 147

GAS COALS.

Penn Gas Coal Co., Phila., Pa. ... 149
Perkins & Co., New York City ... 148
Despard Gas Coal Co., Baltimore, Md. ... 149
Westmoreland Coal Co., Phila., Pa. ... 149
Berwind-White Coal Mining Co., New York and Phila. 148

CANNEL COALS.

Perkins & Co., New York City ... 148

GAS ENRICHERS.

Standard Oil Co., New York City ... 149
The Sun Oil Co., Pittsburgh, Pa. ... 149

COKE CRUSHER.

C. M. Keller, Columbus, Ind. ... 149

CONVEYING MACHINERY.

C. W. Hunt Company, N. Y. City ... 137

GAS GAUGES.

The Bristol Co., Waterbury, Conn. ... 137

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 147
Isbell-Porter Co., New York City ... 154
The Wilder Mfg. Co., Phila., Pa ... 136
R. D. Wood & Co., Phila., Pa. ... 154

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City ... 154
Continental Iron Works, Brooklyn, N.Y. ... 154
G. Shepard Page's Sons, New York City ... 155
Logan Iron Works, Brooklyn, N. Y. ... 156
R. D. Wood & Co., Phila., Pa. ... 154

CEMENTS.

C. L. Gerould & Co., Mount Vernon, N.Y. ... 150

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J. ... 150
B. Kreischer & Sons, New York City ... 150
Adam Weber, New York City ... 150
Laclede Firebrick Mfg. Co., St. Louis, Mo. ... 150
Cyrus Borgner, Phila., Pa. ... 150
James Gardner, Jr., Pittsburgh, Pa. ... 150
Henry Maurer & Son, New York City ... 150
Baltimore Retort and Firebrick Co., Baltimore, Md. ... 150
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 150
Brooklyn Firebrick Works, Brooklyn, N. Y. ... 150
F. Behrend, New York City ... 136

INCANDESCENT GAS LAMPS.

Welsbach Commercial Co., Phila., Pa. ... 139

MICA GOODS.

The Mica Mfg. Co., New York City ... 137

BURNERS.

C. A. Gefrorer, Phila., Pa. ... 154
Theo. Clough, Dobbs Ferry, N. Y. ... 136

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn. ... 136

GAS TUBING.

Wm. M. Crane & Co., New York City ... 902

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 147
Greenpoint Chemical Works, Brooklyn, N.Y. ... 147
Henry W. Douglas, Ann Arbor, Mich ... 147

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind ... 144
Isbell-Porter Company, New York City ... 154
Connelly Iron Sponge and Governor Co., New York City 147

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. ... 146
Chapman Valve Manufacturing Co., Boston, Mass. ... 146
R. D. Wood & Co., Phila., Pa. ... 154
Continental Iron Works, Brooklyn, N. Y. ... 154
The P. H. & F. M. Roots Co., Connersville, Ind. ... 144
Isbell-Porter Co., New York City ... 154
The Western Gas Construction Co., Fort Wayne, Ind. ... 146

ELECTRICAL APPARATUS.

Wm. Henry White, New York City ... 155

GAS ENGINES.

Otto Gas Engine Works, Phila., Pa. ... 130
The American Gas Engine Co., Phila., Pa ... 151
Backus Water Motor Co., Newark, N. J. ... 96

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City ... 137
W. G. & G. Greenfield, East Newark, N. J. ... 96

PURIFIER SCREENS.

John Cabot, New York City ... 138

GAS STOVES.

American Meter Co., New York and Philadelphia . 143
The Goodwin Meter Co., Phila., Pa. ... 158
George M. Clark & Co., Chicago, Ills. ... 141
Maryland Meter and Manufacturing Co., Baltimore, Md. 158
William M. Crane & Co., New York City ... 902
Keystone Meter Co., Royersford, Pa. ... 138
A. Weiskittel & Son, Baltimore, Md. ... 60
Detroit Stove Works, Detroit, Mich. ... 95

CHINA GAS KILNS.

William M. Crane & Co., New York City ... 902

GASHOLDER PAINT.

New York Marine Paint Co., Poughkeepsie, N. Y ... 146

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y ... 146

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md. ... 153
Continental Iron Works, Brooklyn, N. Y. ... 154
Deily & Fowler, Philadelphia, Pa. ... 156
Davis & Farnum Mfg. Co., Waltham, Mass. ... 152
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 152
Stacey Mfg. Co., Cincinnati, Ohio ... 155
R. D. Wood & Co., Philadelphia, Pa. ... 154
Logan Iron Works, Brooklyn, N. Y. ... 156
Riter & Conley, Pittsburgh, Pa. ... 136

GAS SECURITIES.

Gustavus Maas, New York City ... 136

BOOKS, ETC.

Scientific Books ... 157
Field's Analysis ... 148
Digest of Gas Cases ... 149
Directory of Gas Companies ... 157
Practical Photometry ... 150
Coal Tar Genealogical Tree ... 148
Management of Small Gas Works ... 142
Handbook on Gas Engines ... 138
Gas Flow Computers ... 138
Hughes' "Gas Works" ... 138

WANTED,

A Canvasser to Sell Gas Apparatus and Machinery.

It is necessary to have a good knowledge of the gas business and of the needs of the trade. Write for interview, stating age and experience, to

1129 1 "CANVASSER," care this Journal.

ENGAGEMENT DESIRED,

As Manager or Superintendent of Gas or Gas and Electric Light Works.

Thoroughly competent and reliable. Address

1129-5teow "ENGINEER," care this Journal.

ENGAGEMENT DESIRED

As Manager or Superintendent of Gas Works,

By a thoroughly competent man.

1127-tf Address "W.," care this Journal.

Position Desired

As Superintendent of Gas Works or Gas and Electric Light Works,

By a man 34 years of age. Sixteen years' experience in the manufacture and distribution of Coal Gas as Supt., and four years in the Electric line. Thoroughly competent to take charge of any plant, separately or combined. A practical mechanic, and understands the erection of gas plants and everything pertaining to the business. Not afraid of work. Salary no object until ability is proven. Best of references.

1103-tf Address "M. E. J.," care this Journal.

Receiver's Sale.

Will be sold between the usual hours of sale on the first Tuesday in February, 1897, at public outcry before the Court House door in Thomasville, Ga., all the property belonging to the Thomasville Gas Works Company, including all the real estate, personal property, mains, pipes, contracts, franchises, books, accounts, notes, security choses in action and all other property. Terms of sale: Cash, $2,000; balance in 30 days, secured. Sold under and by virtue of an order of Superior Court passed October Term, 1896, in the case of S. L. Hayes, Trustee, etc., vs. Thomasville Gas Works Company.

JOHN F. PARKER, Receiver.

FOR SALE.

On account of changing location of our works and purchase of larger holder, we have for sale a Single-lift **Gasholder,** 80 x 20 feet, capacity 100,000 cubic feet. Complete and as good as new. Now in brick tank. Built by Stacey Mfg. Co. in 1889. Holder has cup on bottom for telescoping, and guide framing is arranged and punched for additional section. Can be taken down and re-erected in brick or steel tank, as may be desired. Will be sold cheap.

THE AKRON GAS COMPANY,

1129-14t Akron, Ohio.

FOR SALE,

One 8-Foot Station Meter, with 12-Inch Connections.

In good order and in use. Address

1127-tf NEW HAVEN (CONN.) GAS LIGHT CO.

For Sale.

A Small Gas and Electric Light Plant,

in a Southern city of 3,800 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,

1097-tf Fort Wayne, Ind.

FOR SALE.

Hydraulic, Dip, Branch and Ascension Pipes, Mouthpieces and Lids, for four Benches of 5's and for one Bench of 3 retorts.

Two Coolers, or Air Condensers, each of 150 000 cubic feet capacity.

Multitubular Condenser, shell, 36 in. diameter, with 98 2-in. tube, 10 ft. 6 in. long.

D-Shaped Tar Extractor, 8 ft. long, 1 ft. 6 in. deep.

Scrubber, 48 in. diameter, 11 ft. 9 in. high. Three manholes, 11 in. by 15 in.

8-inch Center Seal. Four Purifiers, 8 ft. x 6 ft.

KEY CITY GAS CO.,

1119-tf Dubuque, Iowa.

GAS COMPANY SECURITIES

A SPECIALTY.

Brooklyn,
Columbus,
Consolidated of New Jersey,
Detroit,
Madison,
Milwaukee,
Grand Rapids,
New York,
Syracuse,
St. Paul.

CUSTAVUS MAAS,

Telephone, 2137 Cortlandt. 26 Broad St., N. Y.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to

STROH & OSIUS, Pat'ees, Ct

Mich. Ammonia Works, Detroit, Mich

F. BEHREND,

SOLE IMPORTER OF THE CELEBRATED

German (Stettin-Didier) Clay Gas Retorts,

BLOCKS, TILES, FIREBRICKS, FIRE CEMENT,

Stettin "Anchor" & "Eagle" Brand Portland Cement

10 & 12 Old Slip New York.

THEO. CLOUGH,

(Established 1870.)

SOLE MANUFACTURER OF THE

Trade Mark Trade Mark

Maxim & Clough Adjustable Gas Burners

Reg. Reg.

E. H. Nickel Tips for Water Gas a Specialty.

THEO. CLOUGH, - - Dobbs Ferry, N. Y.

A CONVENIENT BINDER for the JOURNAL

STRONG.
DURABLE.
LIGHT.
SIMPLE
CHEAP.
HANDSOME.
Price, $1.

A.M. Callender & Co.,
32 Pine st.,
N. Y. City.

Patent Lava Gas Tips.

UNIFORMITY GUARANTEED.

ALL SIZES AND SHAPES.

D. M. STEWARD MFG. CO.,
CHATTANOOGA, TENN.

THE ANDERSON Patent Cutter Carrying Link

Made in all sizes.

Will cut from 2 in. to 24 in.

Pipe Cutting Tool

For Cutting Cast, Wrought Iron, Gas & Water Pipes.

WM. ANDERSON,
425 Meridian Street,
EAST BOSTON, MASS., or

WALDO BROS.,
88 Water Street, Boston, Mass.

THE GREATEST IMPROVEMENT IN GAS LIGHTING

Has been made by

WILDER'S VOLUMETRIC GOVERNORS.

They control the pressure at the burner, and deliver the quantity for which they are set regardless of high or low pressure in the supply.

WELSBACH LIGHTS are fully controlled, and the governors soon pay for themselves by preventing the breaking of mantles and chimneys. Thousands are already in use. Orders may be given to the Welsbach Co., or sent to ourselves.

THE WILDER MANFG. CO., - - 818 Cherry St., PHILADELPHIA.

RITER & CONLEY, PITTSBURGH, PA.

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

The Pioneer Vertical Water-Tube Boiler of the World!

THE HAZELTON OR PORCUPINE BOILER.

After Sixteen Years of Active Service in all the Principal Industries, this Boiler has Proven Itself Superior to all Others in Economy of Fuel, Durability, Safety and General Efficiency.

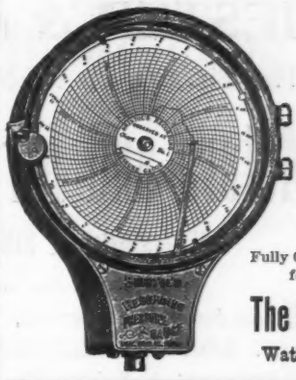
NO EXPLOSIONS OR ACCIDENTS OF ANY KIND.

Correspondence Solicited.

The HAZELTON BOILER COMPANY,

Sole Proprietors and Manufacturers,

Cable Address, "Palla," New York. Tele., "1229-18th St.," New York. Gen'l Office, 716 E. 13th St., N.Y., U.S.A.



BRISTOL'S RECORDING

PRESSURE GAUGE.

For continuous records of **Street Gas Pressure**

Simple in Construction, Accurate in Operation, Low in Price.

Fully Guaranteed. Send for Circulars.

The Bristol Co.,

Waterbury, Conn.

G. W. HUNT COMPANY.

COKE CARS for Gas Works,
TIP CARS for Carrying Ashes,
CHARGING CARS for Bringing Coal from the Storage Bins to Boiler Room and Retort Houses.

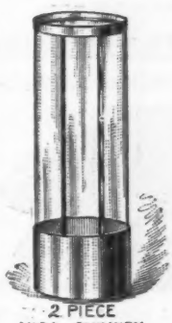
INDUSTRIAL RAILWAYS

Specially designed for handling material in and around

Gas Works, Coal Yards, Factories, Etc., Etc.

45 Broadway, N. Y. City.

Our Mica Chimneys



2 PIECE MICA CHIMNEY.

Etched Chimneys to Order.

For Welsbach Lights

ARE THE

BEST IN THE WORLD.

Get Catalog and Discounts.

The MICA MFG. CO

Micasmiths,

88 Fulton Street, N. Y. City.

AMERICAN GAS COMPANY,

222 South Third Street, Philadelphia, Pa.

Owns, Operates, Buys and Leases Gas Works.

ALSO UNDERTAKES ALL KINDS OF CONSTRUCTION WORK.

Especially the Installation or Extension of Plants for the Manufacture of Gas from Caking Coal.

The attention of Gas Managers is particularly called to the many improvements in this method of manufacture instituted during the past fifteen years, and the extremely low cost at present of Coal Gas.

CORRESPONDENCE RESPECTFULLY SOLICITED. Address

GEO. G. RAMSDELL, Gen'l Mangr

WIESTER & CO., 17 & 19 New Montgomery St., San Francisco, Cal.,

PACIFIC COAST AGENTS FOR **THE KEYSTONE METER CO.**

Gas Meters and All Apparatus for Measuring and Testing Gas.

REPAIRING, ALL KINDS OF METERS, PROMPTLY, AND SATISFACTION GUARANTEED

Other Agencies and Showrooms:

New York, New Jersey & Connecticut,
THE BARTLETT LAMP MFG. COMPANY,
66 W. Broadway, N. Y. City.

Western,
CAHILL, SWIFT & CO.,
121-207 S. 7th St., St. Louis, Mo.,

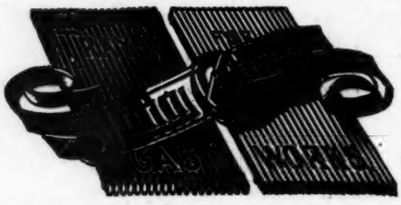
Main Office:
ROYERSFORD, PA.

••• A Full Stock ••• All Sizes on Hand ••• At these Points •••

Special Trays for Iron Sponge or Oxide of Iron,

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.



553-557 West Thirty-third Street, New York.

We also make the Cheapest and Strongest
REVERSIBLE BOLTED TRAYS IN THE MARKET.
Send for Circulars.

HUGHES' "GAS WORKS,"

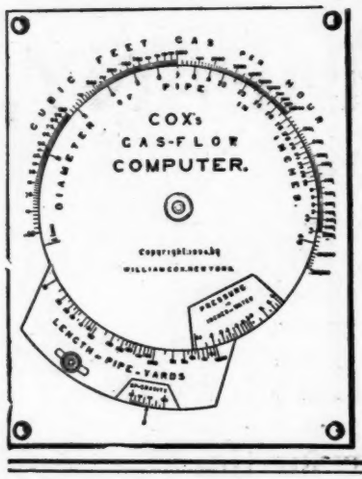
Their Construction and Arrangement,

And the Manufacture and Distribution of Coal Gas.

Originally written by SAMUEL HUGHES, C.E.
Rewritten and Much Enlarged by WILLIAM RICHARDS, C.E.

Eighth Edition, Revised, with Notices of Recent Improvements. **Price, $1.65.**

A. M. CALLENDER & CO., No. 32 Pine Street, N. Y. City.



Cox's Gas Flow Computer.

1. It gives at a glance the discharge of gas from pipes 1 to 48 inches in diameter and 10 to 10,000 yds. long, for any pressure from 0.01 to 10.0 inches of water, and any specific gravity from 0.40 to 1.00.
2. When the required discharge and the length of pipe are given, the diameter corresponding to any pressure is at once seen.
3. When the required discharge and the length of pipe are given, the pressure corresponding to any diameter is at once found.
4. Any suitable combination of the different factors of any problem, under all possible conditions, may be immediately found.

It Prevents Errors and Saves Hours of Tiresome Calculations.

Price, $5.00, per Registered Mail.

For sale by

A. M. CALLENDER & CO., 32 Pine St., N. Y. City.

PRACTICAL HANDBOOK ON

GAS ENGINES

With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the author by GEO. M. RICHMOND, M.E.

Price, $1.00.

A. M. CALLENDER & CO., 32 Pine Street, New York.

INJUNCTION ISSUED AGAINST INFRINGERS.

On September 23d the United States Circuit Court for the Southern District of New York granted an injunction restraining and enjoining the further infringement of our Welsbach patent. READ IT.

UNITED STATES CIRCUIT COURT,
Southern District of New York.

WELSBACH LIGHT COMPANY,
vs.
A. LIEBES. } IN EQUITY.

The President of the United States,

To A. LIEBES, and his servants, agents, attorneys and workmen, GREETING:

WHEREAS, It has been represented to us in our Circuit Court of the United States for the Second Circuit and Southern District of New York, that Letters Patent of the United States No. 438,125, were issued in due form of law on the 7th day of October, 1890, to Carl Auer von Welsbach, assignor of the complainant, then known as "Welsbach Incandescent Gas Light Company of New Jersey," and that the complainant herein is the owner of said Letters Patent, and that you, the said A. Liebes, have infringed the rights secured by the aforesaid Letters Patent, by making, using and selling to others to be used, incandescent devices for gas burners, embodying and containing the invention and improvements described and claimed in said Letters Patent No. 438,125.

NOW, THEREFORE, We do strictly command and enjoin you, the said A. Liebes, and your attorneys, agents, servants and workmen, under the penalties which may fall upon you in case of disobedience, that you forthwith and forever desist from directly or indirectly making, or causing to be made, delivering, vending, or causing to be sold, offering for sale, using, or causing to be used in any manner, any incandescent devices for gas burners, like, or similar to those which you have heretofore made, used or sold, containing or embodying the invention and improvements described in said Letters Patent No. 438,125, and claimed in the claim thereof, and from counterfeiting or imitating the said invention or improvements or any part or parts thereof, and from in any manner or way whatsoever, violating or infringing the said Letters Patent No. 438,125 and the claim thereof, and from doing, or causing to be done, any other act or thing whatsoever in infringement of the said Letters Patent No. 438,125.

WITNESS, The Honorable Melville W. Fuller, Chief Justice of the United States, at the City of New York, in the Southern District of New York, this twenty-fourth day of September, A. D., 1896.

(SEAL) JOHN A. SHIELDS, Clerk.

(Endorsed) U. S. Circuit Court, Southern District of New York, in Equity.—Welsbach Light Company vs. A. Liebes. Injunction.

A Copy of a Writ of Injunction this day issued out of my office. JOHN A. SHIELDS, Clerk.

We shall proceed against all infringers; manufacturers, dealers and users being equally liable to injunction and damages. The decree of the court awarding the injunction also awards profits and damages. Do not be misled or deceived by guarantees offered by infringers, as such guarantees will not protect you against suit, injunction and damages. For your own protection see that you get the genuine Welsbach light. All other incandescent gas lights are infringements.

WELSBACH LIGHT COMPANY.

The Gas Exposition.

THE GAS INDUSTRIES COMPANY, INCORPORATED,

Offices, 280 Broadway, New York City.

To be He'd at MADISON SQUARE GARDEN, NEW YORK,

Beginning January 27 and Closing February 6, 1897.

OFFICERS:

President, PROF. CHARLES F. CHANDLER.

Vice Presidents, THOMAS F. ROWLAND, EMERSON McMILLIN, WALTER WOOD, THOMAS DOLAN, WM. R. BEAL GEN. ANDREW HICKENLOOPER.

E. C. BROWN, Managing Director. L. J. MONTGOMERY, Secretary. GEORGE W. DOANE, Treasurer.

EXECUTIVE COMMITTEE:

E. C. BROWN, Chairman. EMERSON McMILLIN. COL. W. E. BARROWS. WM. H. BRADLEY. WALTON CLARK.

DIRECTORS:

Dr. Robert Amory, Boston.
Hon. Calvin S. Brice, New York.
Gov. Asa S. Bushnell, Columbus, O.
Wm. R. Beal, New York.
Col. W. E. Barrows, Gloucester, N. J.
Wm. H. Bradley, New York.
E. C. Brown, New York.
Prof. Charles F. Chandler, New York.
Walton Clark, Philadelphia.

Thomas Dolan, Philadelphia.
G. W. Doane, New York.
A. B. Eilbeck, Philadelphia.
H. E. Gawtry, New York.
E. P. Gleason, New York.
T. J. Hayward, Baltimore.
Prof. William Hallock, New York.
Alexander C. Humphreys, New York.
Gen. Andrew Hickenlooper, Cincinnati.

Charles E. Judson, Chicago.
Gen. James Jourdan, Brooklyn.
John Kean, Elizabeth, N. J.
Emerson McMillin, New York.
Edm'd H. McCullough, Philadelphia.
Dr. Henry Morton, Hoboken, N. J.
Prof. T. C. Mendenhall, Worcester, Mass.
Martin Maloney, Philadelphia.
Wm. J. Murphy, Minneapolis.

Albion L. Page, New York.
Thomas F. Rowland, New York.
Frank Tilford, New York.
Prof. R. H. Thurston, Ithaca N. Y.
Eugene Vanderpool, Newark, N. J.
Capt. Wm. H. White, New York.
Dr. Wm. H. Wahl, Philadelphia.
Walter Wood, Philadelphia.

The Gas Associations have Appointed the Following Representatives:

W. M. EATON, Michigan Gas Asso. **J. A. BRITTON,** Pacific Coast Gas Asso. **IRVIN BUTTERWORTH,** Ohio Gas Light Asso. **GEO. T. THOMPSON,** Western Gas Asso.

C. J. R. HUMPHREYS, American Gas Lt. Asso. C. H. NETTLETON, New England Asso. of Gas Engineers.

Every indication points to the attendance of gas men from near by as well as from the most remote sections of the country. Arrangements are now under way for providing hotel and railway facilities for members of the gas fraternity who may wish to visit New York during the Exposition.

Several New York hotels have offered special rates.

Full particulars on these points will be given very shortly.

The Historical Exhibit will embrace many articles of surpassing interest. A celebrated collection of ancient lamps and lighting appliances, consisting of several hundred rare specimens never exhibited outside the great institution in which the collection is now lodged, is promised.

GAS MEN'S NIGHT.

The Ohio Gas Light Association will hold its annual meeting in this city during the Gas Exposition. Date, February 3 and 4. The management has designated Wednesday evening, February 3, as **Gas Men's Night.** A programme will be made up covering this feature that will appeal to all as befitting the occasion.

THE TIFFANY GAS TOWER,

With its Myriad of Lights and Beautiful Decorative Effects, Worth a Thousand Mile Journey to See.

"Keeping Everlastingly at it Brings Success,"

Is one Well-known Advertiser's Motto.

We believe it. For buyers of Gas Stoves are constantly coming our way.
They can't help it. The people know what they want, and when they ask for

Jewel Gas Stoves

They can't be induced to take any other make. Splendid results from our New Burners.
Lots of inquiries. It's taking—it's so simple. Never burns yellow. Don't pop back.
You can take it apart with your fingers. The same perfection in everything we make.

GEORGE M. CLARK & COMPANY, 149-161 Superior St., CHICAGO

Makers of High Grade Gas Stoves and Appliances.

Look for Our Exhibit at the Gas Exposition. **Catalog ready February 1st.**

FRED. BREDEL, C.E.

Coal and Water Gas Plants,

OWN SYSTEM.

Recuperative Furnaces, Washers, Condensers, Purifiers, Purifying Machines.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

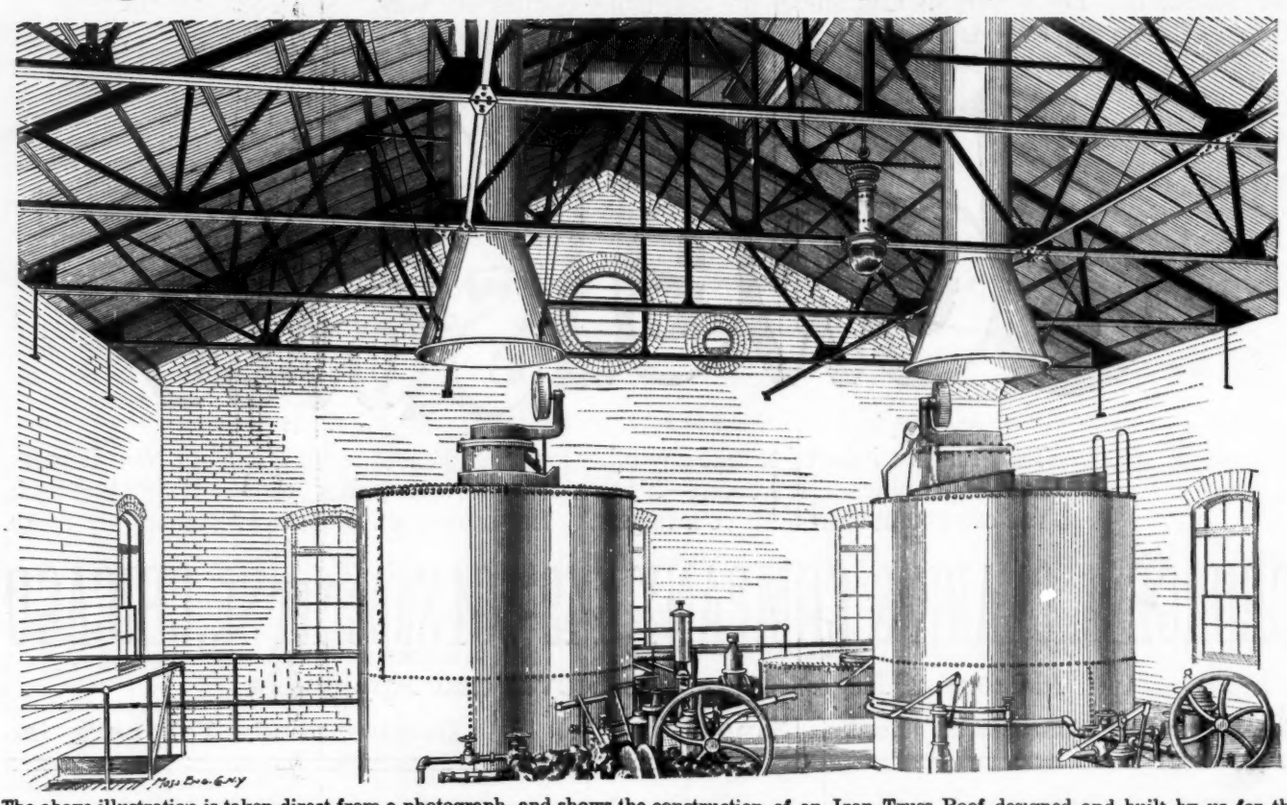
COMPLETE GAS WORKS, COKE CONVEYERS, ETC.

No. 118 Farwell Avenue, · · Milwaukee, Wis.

CHAS. M. JARVIS. Prest. & Chief Engineer. B[illegible]RR K. FIELD, Vice-President. GEO. H. SAGE, Secretary. FRANK L. WILCOX. Treasurer.

THE BERLIN IRON BRIDGE CO.

Engineers, Architects, and Builders of Iron and Steel Structures.



The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Providence Gas Light Company, at Providence, R. I. The building is 40 ft. in width by 100 ft. in length, the side walls being of brick and the roof being entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The building is ventilated by our Improved Ventilators, extending the full length of the roof, with side shutters opened and closed by cords from the floor. No woodwork is used in any way about the construction of the building.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

ALEX. C. HUMPHREYS, M.E., MANHATTAN LIFE BUILDING, (64 BROADWAY,) NEW YORK.

CABLE ADDRESS, LONDON & NEW YORK, "HUMGLAS."

ARTHUR G. GLASGOW, M.E., 9 VICTORIA ST., LONDON, S. W., ENGLAND.

HUMPHREYS & GLASGOW,

CONTRACTING AND CONSULTING

GAS ENGINEERS.

WATER GAS PLANT A SPECIALTY.
GAS PROPERTIES EXAMINED AND VALUED.
ADVICE AS TO IMPROVEMENT OF GAS PROPERTIES AND MANAGEMENT.

THE MANAGEMENT OF SMALL GAS WORKS.

By C. J. R. HUMPHREYS.

Price $1.

A. M. CALLENDER & CO., No. 32 Pine Street New York.

(Copyrighted, 1894, by the AMERICAN METER CO.

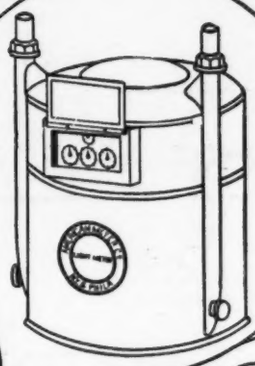
AMERICAN METER CO.

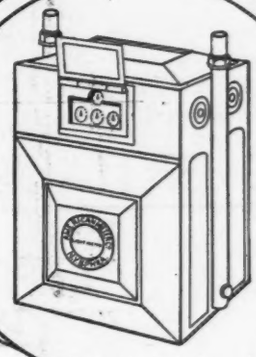
ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

SAN FRANCISCO.

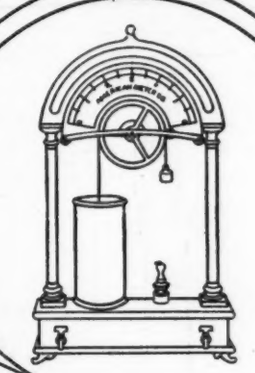


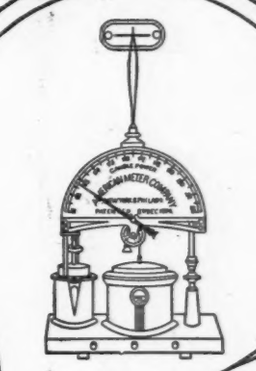


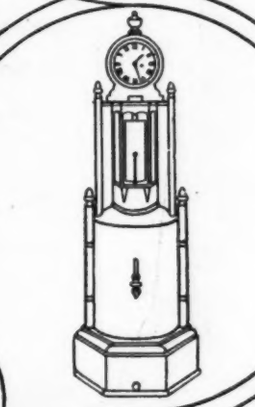
PUBLIC LIGHTING TABLE.

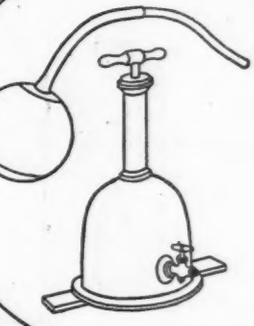
FEBRUARY, 1897.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Mon.	1	5.50 PM NM	6.10 AM	5.05	6.15
Tue.	2	5.50	6.10	5.05	6.15
Wed.	3	5.50	6.10	5.05	6.15
Thu.	4	5.50	6.10	5.05	6.15
Fri.	5	5.50	6.10	5.10	6.10
Sat.	6	9.40	6.10	5.10	6.10
Sun.	7	10.40	6.00	5.10	6.10
Mon.	8	11.40	6.00	5.10	6.10
Tue.	9	12.40 AM FQ	6.00	5.10	6.10
Wed.	10	1.40	6.00	5.10	6.10
Thu.	11	2.40	6.00	5.10	6.10
Fri.	12	3.30	6.00	5.20	5.55
Sat.	13	4.10	6.00	5.20	5.55
Sun.	14	4.50	5.50	5.20	5.55
Mon.	15	No L.	No L.	5.20	5.55
Tue.	16	No L. FM	No L.	5.20	5.55
Wed.	17	No L.	No L.	5.20	5.55
Thu.	18	6.10 PM	8.30 PM	5.20	5.55
Fri.	19	6.10	9.40	5.30	5.55
Sat.	20	6.10	10.50	5.30	5.55
Sun.	21	6.20	12.10 AM	5.30	5.55
Mon.	22	6.20	1.30	5.30	5.55
Tue.	23	6.20 LQ	2.40	5.30	5.55
Wed.	24	6.20	3.50	5.30	5.55
Thu.	25	6.20	4.40	5.30	5.55
Fri.	26	6.20	5.30	5.30	5.45
Sat.	27	6.20	5.30	5.30	5.45
Sun.	28	6.20	5.30	5.30	5.45



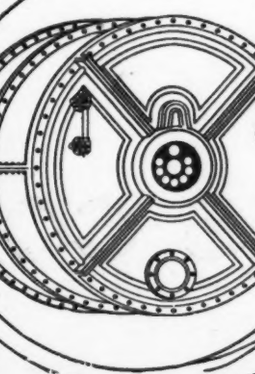


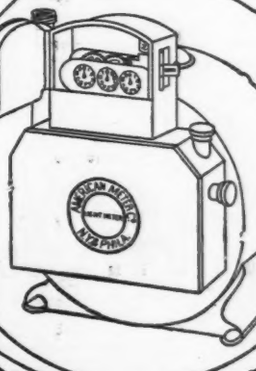




TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	233.00	January	423.20
February	187.20	February	355.25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151.40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45





P. H. & F. M. ROOTS CO.,

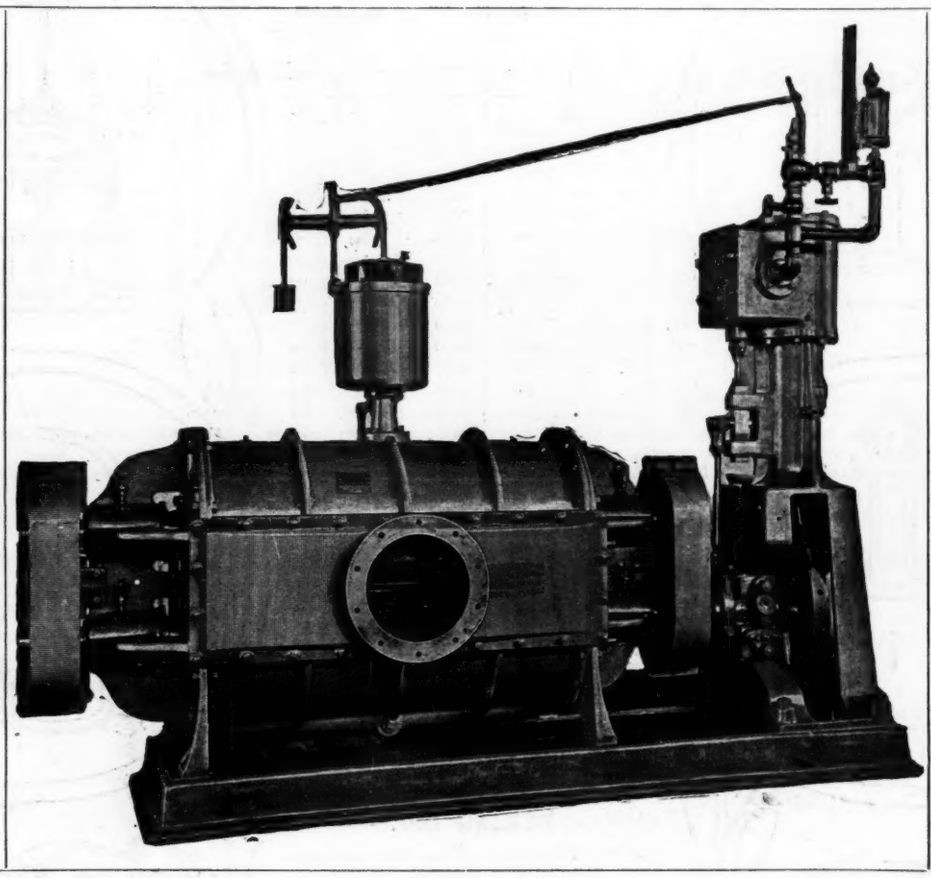
Connersville, Ind.

GAS EXHAUSTERS. BYE-PASS VALVES.

AUTOMATIC GAS GOVERNORS.

GAS VALVES. PIPE FITTINGS.

New Design of Direct Connected Engine and Exhauster on Same Bedplate.



This Design is Used for all Exhausters from No. 7 to No. 10, Inclusive.

Write for Illustrated Catalogue.
Estimates submitted on application.

P. H. & F. M. ROOTS CO.,

Connersville, Indiana.

New York Office, 109 Liberty Street. J. B. STEWART. Manager.

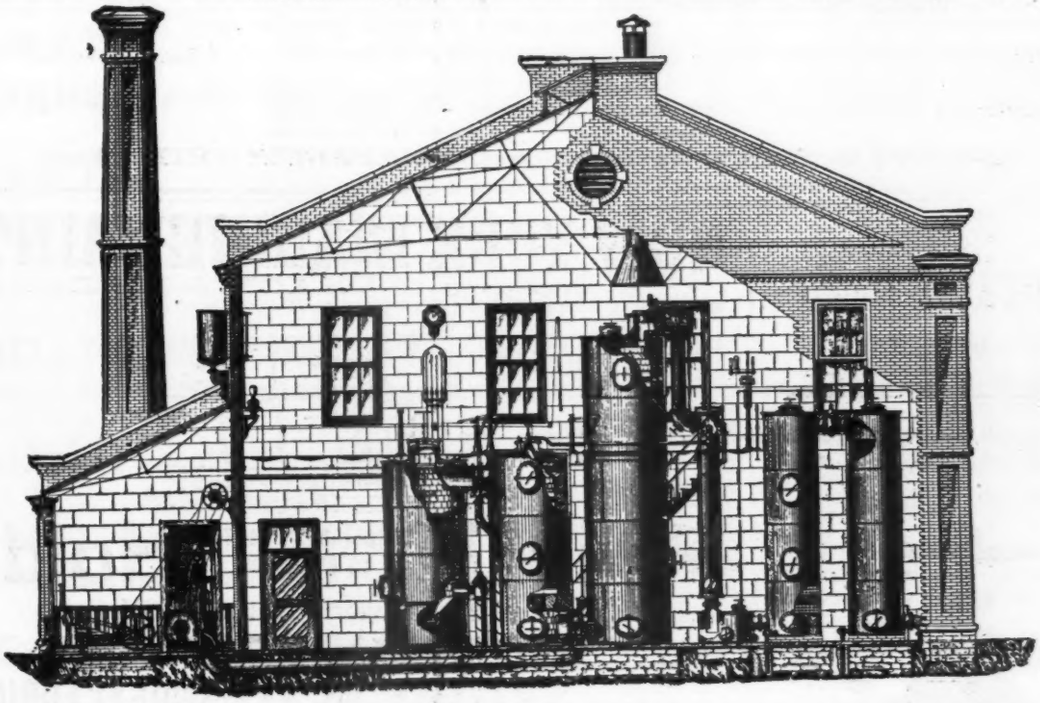
THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

BUILDERS OF

THE STANDARD LOWE WATER GAS APPARATUS.



Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

BUILDERS, LESSEES AND PURCHASERS OF GAS WORKS.

Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

PAMPHLETS, PLANS AND ESTIMATES FURNISHED UPON APPLICATION.

THE WESTERN GAS CONSTRUCTION CO.,

ENGINEERS and BUILDERS,

FORT WAYNE, INDIANA.

Water Gas Apparatus . . .

Improved Double Superheater Settings,
Improved Single Superheater Settings,
Special Designs for Small Works.

Our apparatus is designed to use any grades of Oils or Naphthas, Gas House or Oven Coke, or Anthracite Coal. Results are Guaranteed.

Coal Gas Apparatus . . .

Agents and Builders. { **For FRED. BREDEL—Washers and Purifying System, Mouthpieces and Bench Castings,**
For GEO. SHEPARD PAGE'S SONS—Walker Ammonia Concentrators and Sulphate Stills, Walker Patent Mouthpieces.

Manufacturers of THE WESTERN GAS VALVE, all Iron, Double Gate, 4 to 36 Inch.

Purifiers, Condensers, Scrubbers, Street Main Specials, Iron Roofs, Iron Floors, Oxide Elevators and Conveyer Machinery.

NEW YORK OFFICE, 32 Pine Street, WM. HENRY WHITE, Engr.

THE

LUDLOW VALVE MFG. CO.,

MANUFACTURERS OF

VALVES,

Double and Single Gate, ¾ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

SEND FOR CIRCULAR.

SEND FOR CIRCULAR.

ALSO,

Hydraulic Main Dip Regulators, Check Valves, Foot Valves, Yard Wash and Fire Hydrants.

OFFICE AND WORKS:
938 to 954 River St., & 67 to 83 Vail Av.
TROY, N. Y.

NEW YORK MARINE PAINT CO.

Successors to TRACY & HADDEN.

TRADE MARK
MANUFACTURERS OF

PAINT PECULIARLY ADAPTED TO STAND ON Holders

And all Ironwork about Gas Works.

POUGHKEEPSIE, N. Y.

CHAPMAN VALVEMANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.

Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston, Mass.
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
70 Rush St., Near Division Ave., Brooklyn, N. Y.

The Gas Engineer's Laboratory Handbook.

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 32 Pine Street, N.Y. City

NATIONAL GAS AND WATER CO.,

218 La Salle Street, Chicago.

Builder and Operator of Gas Works.

The Rew Soft Coal Carbureted Water Gas Apparatus.

TESTED BY THREE YEARS' PRACTICAL OPERATION, AND FULLY GUARANTEED.

Plans and Estimates Upon Application.

IRWIN REW, President and Treasurer. E. E. MORRELL, Engineer.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR. OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION! REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 365 Canal St., New York.

Practical Photometry.

A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.

By William Joseph Dibdin.

Price, $3.00.

A. M. CALLENDER & CO.,

32 Pine Street, N. Y. City.

DOUGLAS' FERRIC OXIDE

For Gas Purification

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West.

Full information, with references to many users, and prices delivered in any locality, furnished on application to

H.W. Douglas (Supt. Ann Arbor Gas Company) **Ann Arbor, Mich.**

IRON MASS

For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

Greenpoint Chemical Works.

JOHN SCHRIEVER, Manager.

Greenpoint Ave. & Newtown Creek, Brooklyn N.Y

BOOKS.

DISTILLATION OF COAL TAR AN AMMONIACAL LIQUOR.

By Georgan Lunge. Price $12.50.

TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS.

By David A. Graham. 8vo., Cloth. Price $3.

Orders for these books may be sent to this office.

A. M. CALLENDER & CO., Pine St., N. Y. City

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER.

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER.

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY

H. E. PARSON, Supt., 621 Broadway N. Y.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,

Clinch Valley, Thacker & Logan Gas Coals

Old Kentucky Shale and O. K. Boghead.

Shipments from New York, Philadelphia, Baltimore and Norfolk.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

FIELD'S ANALYSIS

For the Year 1895.

An Analysis of the Accounts of the Principal Gas Undertakings in England, Scotland, and Ireland. Being the Twenty-seventh Year of Publication. Compiled and Arranged by

JOHN W. FIELD, Sec. & Gen. Mangr. of The Gas Lt. & Coke Co., London.

Price, $5. For Sale by

A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.

Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng., having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

GAS ENRICHERS. GAS COALS. GAS COALS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point, Baltimore, Md.
OFFICE, - - - 44 South Street, Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS, { BANGS & HORTON 60 Congress St., Boston.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

The Gas Engineer's Laboratory Handbook.

BY JOHN HORNBY, F.I.C. Price, $2.50.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY

GREENOUGH'S "DIGEST OF GAS CASES."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

— THE —

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened and Prepared for Gas Purposes.

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

Room 720, Reading Terminal Building, Phila., Pa.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No 1 (Lower Side), South Amboy, N. J.

EDMUND H. MCCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE SUN OIL CO.,

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence S

26 Broadway, New York City

RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.

Office, 88 Van Dyke St., Brooklyn, N. Y.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { CAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Exclusive Agents for

The Mitchell Half-Depth Regenerative Furnace.

This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

Proprietors of the Coze System of Inclined Retorts.

Office: 901 Pine St., **St. Louis, Mo.**

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

Office, 119 E. 23d St., New York.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

Adam Weber,

Proprietor,

Manhattan Fire Brick and Enameled Clay Retort Works.

Works, Weber, N. J.

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces

And Standard Fire Brick and Gas Retorts.

Works,
LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Successor to WILLIAM GARDNER & SON

Hamilton Building, Fifth Avenue,
PITTSBURGH, PA. P. O. Box 373.

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A cement of great value for patching retorts, putting on mouth-pieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

PRICE LIST.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 200 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD & CO.,

N. 3d & Prospect Ave., Mt. Vernon, N. Y.

Western Agent, H. T. GEROULD, Centralia, Ills.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,
417 Pine Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec'y
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Baker Oven Tiles 12 x 12 x 2 and 18 x 18 x 2.

WALDO BROS., 83 WATER ST., BOSTON, MASS

Sole Agents for New England States.

PRACTICAL PHOTOMETRY.

A Guide to the Study of the Measurement of Light.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations Price, $3.00. A. M. CALLENDER & CO 32 Pine Street, N. Y. City

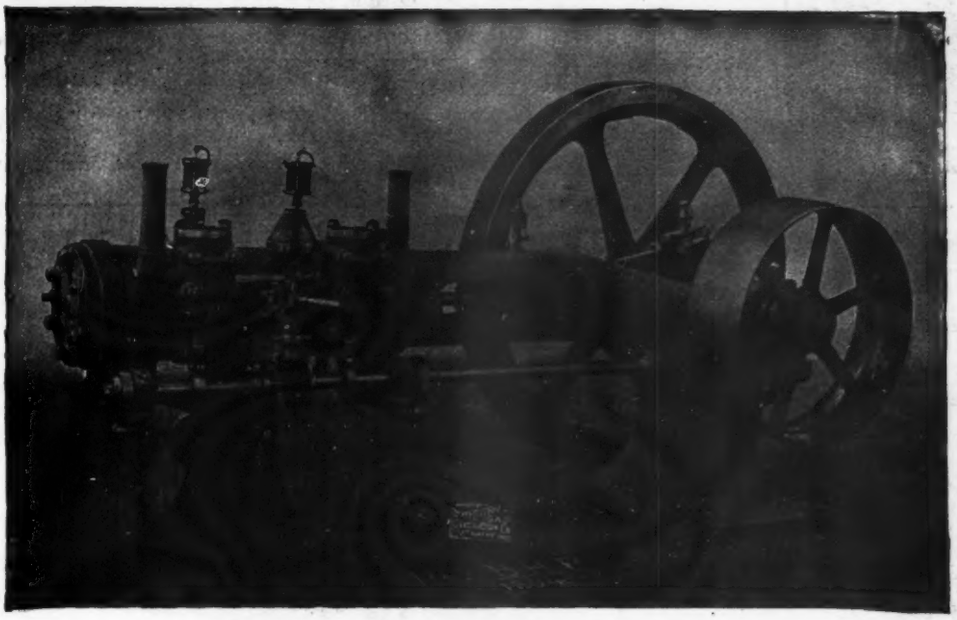
WM. W. GOODWIN, Prest. O. N. CULDLIN, V.-Prest. & Treas. H. B. GOODWIN, Sec. ERNEST F. LLOYD, Asst. Sec

THE AMERICAN GAS ENGINE CO.,

MANUFACTURERS OF

The Double-Acting Gas Engine,

Under the Patents of Griffin, and Dick, Kerr & Co., of London and Kilmarnock.



Single Cylinder.

Impulse Every Revolution.

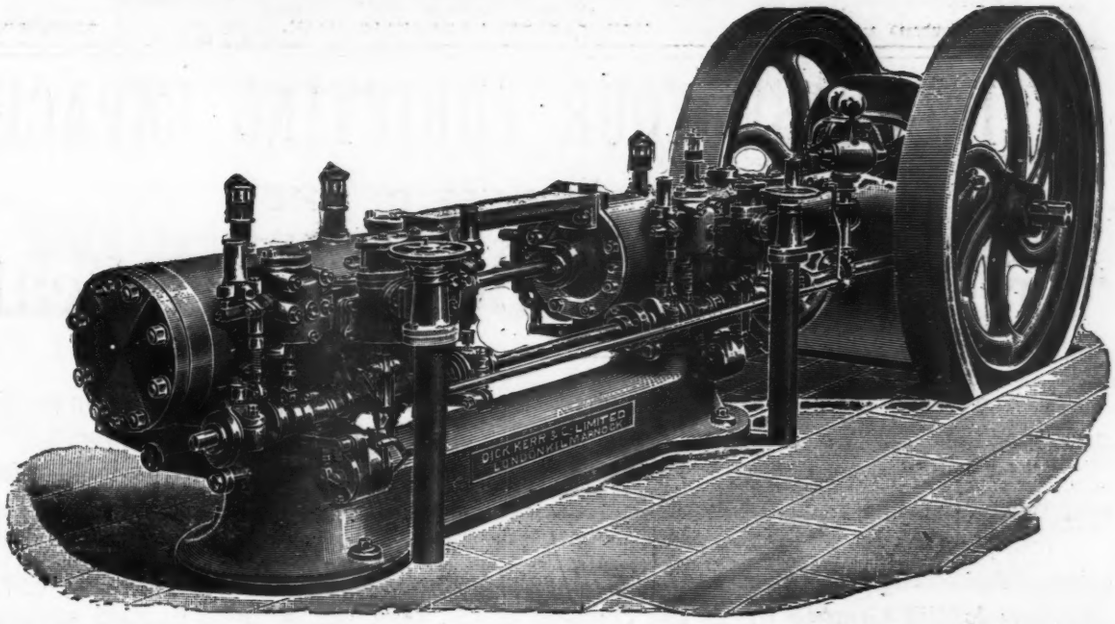
(Two Strokes.)

15 to 500 Horse Power.

For General Work and Isolated Electric Plants.

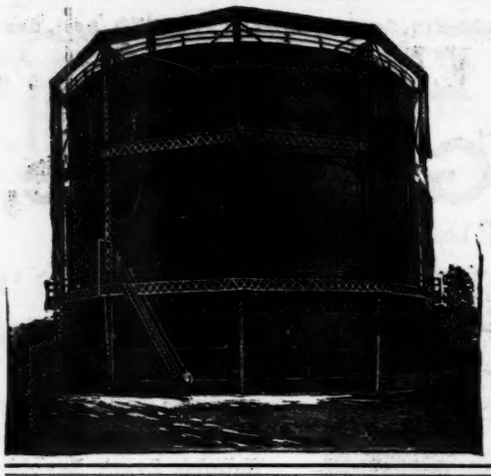
Tandem Cylinder. Impulse Every Stroke. 100 to 1,000 Horse Power.

For Central Stations and all work requiring extreme steadiness.



ESSENTIAL PRINCIPLE.—An impulse at each end of piston; using half force to each impulse; doubling the steadiness; reducing the wear on moving parts, and weight for given power. **CONSTRUCTION.**—The piston rod works through stuffing box in front end of cylinder, and connecting rod is carried in a cross-head working in a slide in frame, as in ordinary steam engine practice. All valves are of the poppet type, operated by cams on a single cam-shaft, giving positive movement to every working part. Tube or electric ignition. **RESULT.**—An engine of extreme simplicity and steadiness of action, the even wear on the cylinder and all working parts assuring increased economy, long life, and minimum cost in repairs. **RECORD.**—Successful and constant use in Great Britain for the past eight years. Address

W. W. GOODWIN, President, 532 Bourse Building, Philadelphia Pa. or THE WESTERN GAS CONSTRUCTION CO. Bldrs. & Gen. Agts. Fort Wayne, Ind.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

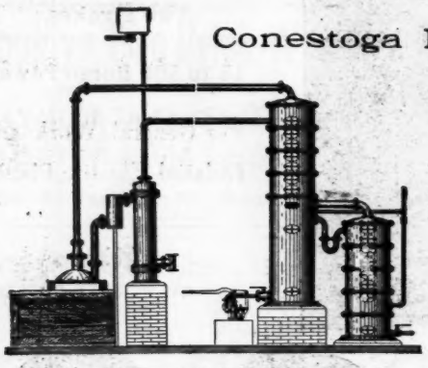
Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

GAS ENGINEERING COMPANY,

INCORPORATED,

Conestoga Building, PITTSBURGH, PA.



AMMONIA MACHINE.

MANUFACTURERS OF

Gas Works Machinery of all kinds,

PATENTEE AND OWNER OF

PITTSBURGH WASHER-SCRUBBER,

SOLE AGENT FOR

FELDMANN AMMONIA MACHINE,

For producing Sulphate, Aqua, Chloride and Concentrated Liquors.

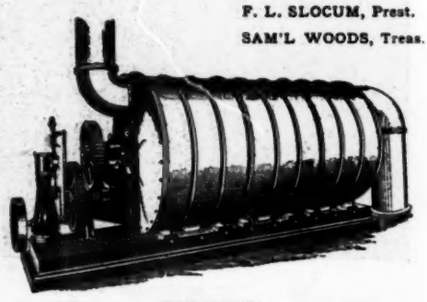
The Erection of Bi-Product Coke Ovens a Specialty.

Faux System of Recuperative Benches,

JAS. GARDNER, JR.,
SOLE CONSTRUCTOR AND BUILDER.

NEW SYSTEM HYDRAULIC MAIN.

F. L. SLOCUM, Prest.
SAM'L WOODS, Treas.



SCRUBBER.

INCREASE YOUR PURIFYING CAPACITY

BY THE USE OF THE

"Crighton" Four-Box Center Seal Cap.

Having recently perfected and patented a Five-way Center Seal Cap, we are now in position to offer and recommend it to Gas Companies for increasing their purifying capacity at a moderate cost.

With this Cap you can have **all your Purifying Boxes in constant use,** and where four boxes are in operation at one time, **the capacity is increased one-third.**

Your present Center Seal can be used, and will **only require a new Cap.** Under ordinary circumstances **the change can be made in one day,** and will not necessitate the disturbing of your connections.

Now is the time to make the change, as the work can be done to good advantage during the season of your lightest output.

For information and prices address

KERR MURRAY MFG. CO.,

Manufacturers of Gas Works Apparatus and Holders,

FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double & Single-Lift

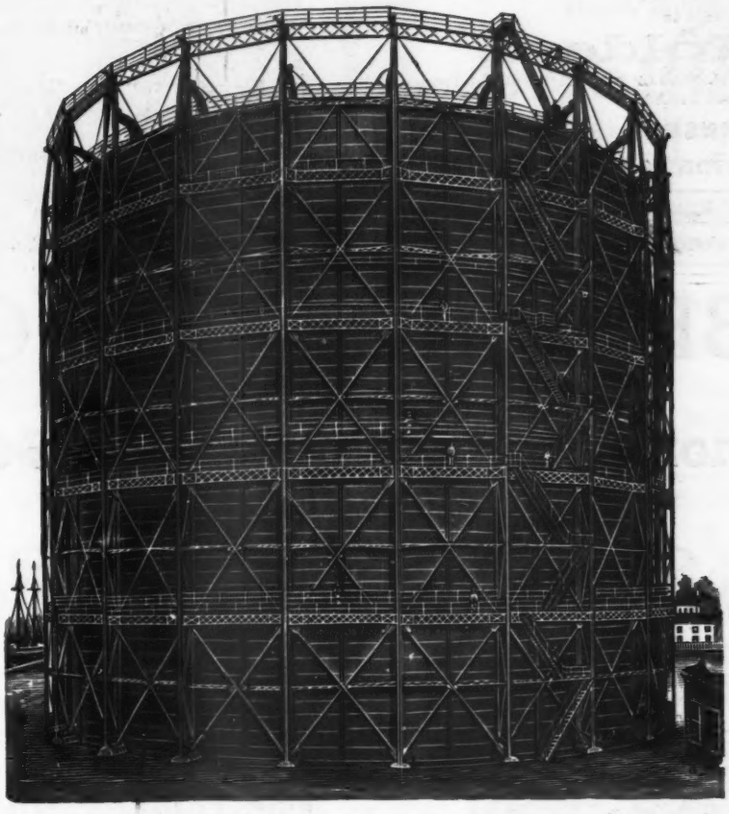
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS



PURIFIERS.

CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS

Boilers.

Three Four-Lift Gasholders, each of 4,289,500 Cubic Feet Capacity, Erected in Chicago.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

W. H. PEARSON, President. J. T. WESTCOTT, Gen'l Mang'r & Treas. L. L. MERRIFIELD, Chief Engineer.

The Economical Gas Apparatus Construction Co., Ld.

269 Front Street, East, - - Toronto, Canada.

ENGINEERS AND BUILDERS

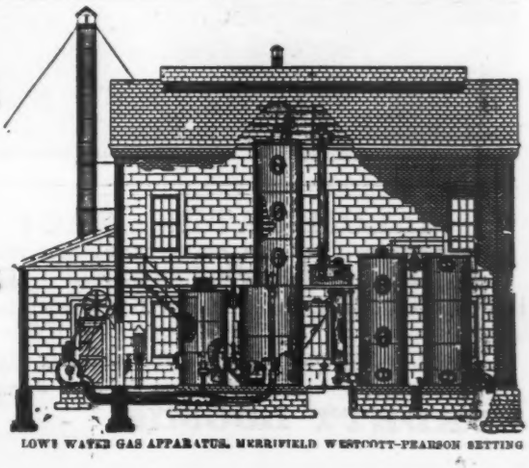
OF THE

Improved Lowe Water Gas Apparatus

Designed to give the Greatest Efficiency when using any kind of Oil, Anthracite Coal, Gas House or Oven Coke.

New Gas Works Built, Present Gas Plants, either Coal or Water, Remodeled

Catalogues, Plans and Estimates Furnished upon Application.



LOWE WATER GAS APPARATUS. MERRIFIELD WESTCOTT-PEARSON SETTING

R. D. WOOD & CO.,

ENGINEERS, IRON FOUNDERS, MACHINISTS.

400 Chestnut Street, Philadelphia, Pa.

MANUFACTURERS OF

CAST IRON PIPE.

BUILDERS OF

Gas Holders,

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

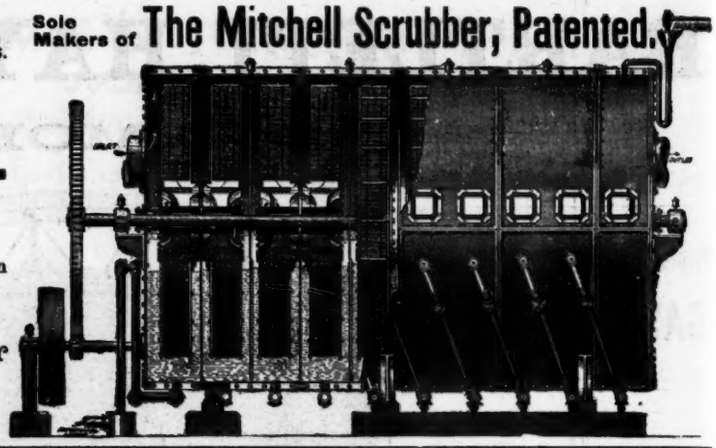
PURIFIERS, CONDENSERS, SCRUBBERS.

The Hopper Automatic Gas Governor

Send for Pamphlet.

Dunham Patent Specials.

Sole Makers of **The Mitchell Scrubber, Patented.**



ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

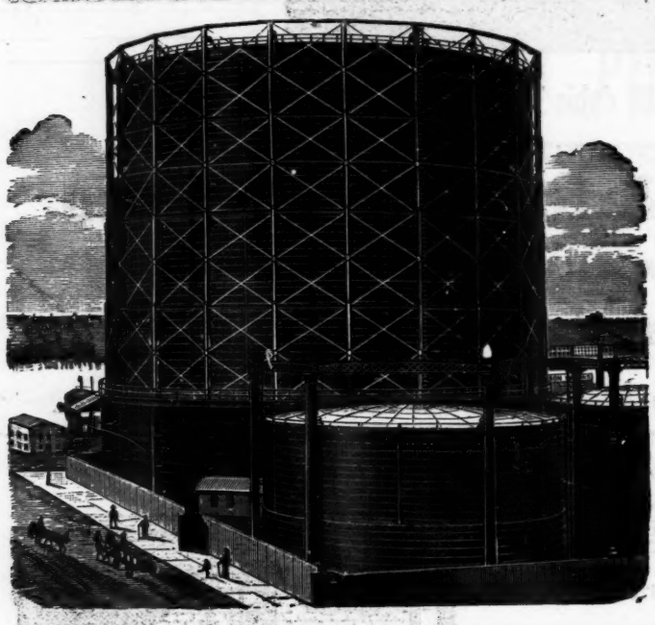
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. — OFFICES — Bridge & Ogden Sts., Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

BROOKLYN, N. Y.

TAKE EAST TENTH OR TWENTY-THIRD STREET FERRIES FROM N. Y. TO GREENPOINT.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.

To Gas Companies.

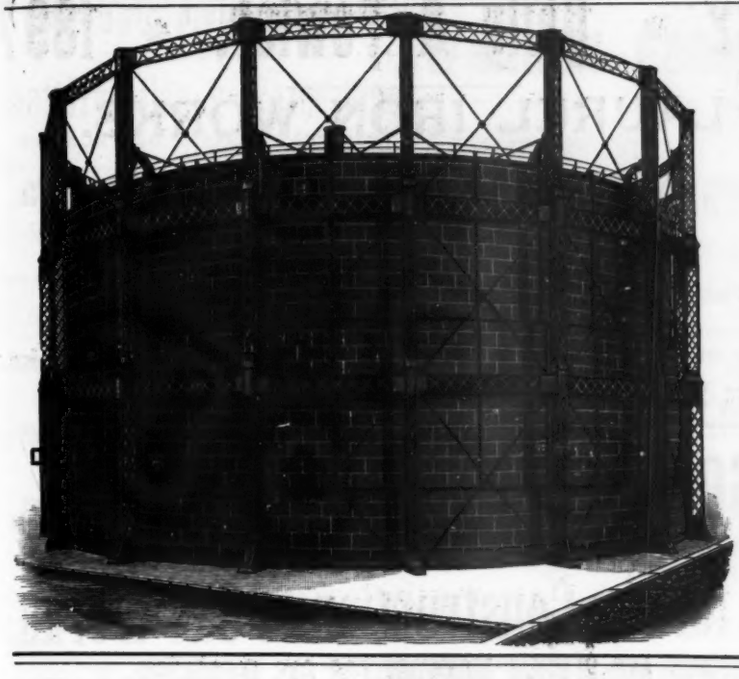
We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th St., Phila., Pa.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO
Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

Cincinnati, Ohio.

George Shepard Page's Sons,

Sole Agents for

The "Standard" Washer-Scrubber,

The Walker Tar and Carbonic Acid Extractor, The Walker Sulphate and Ammonia Still,
The Walker Self-Sealing Pressed Steel Mouthpiece Lids.

The Berlin Center Valve. And Contractors for Ammoniacal Liquor.

No. 69 Wall Street, New York City.

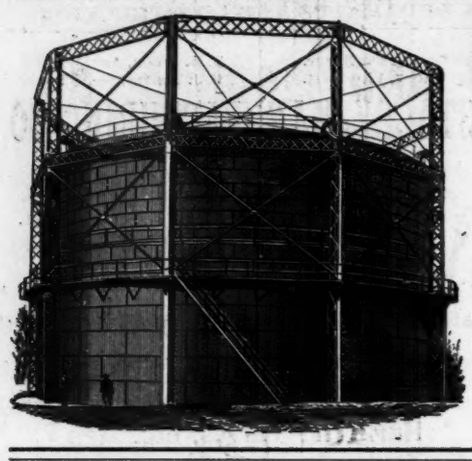
Practical Hints
ON THE CONSTRUCTION AND WORKING OF
Regenerator Furnaces,
By MAURICE GRAHAM, C.E.
Price, $1.25.
A. M. CALLENDER & CO., 32 Pine Street, N. Y.

GEORGE R. ROWLAND.
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

T. G. LANSDEN,
Consulting and Contracting Gas Engineer
Estimates, Plans and Specifications for New Works (Coa or Water Gas), and for Extensions or Alterations.
Room H, 108 N. 4th St., St. Louis, Mo.

WM. HENRY WHITE,
No. 32 Pine Street, - - - New York City.
ENGINEER AND CONTRACTOR FOR THE
ERECTION AND EXTENSION OF
GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited
Plans and Estimates Furnished.



1842 * Deily & Fowler, * 1897

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

JAMES R. FLOYD & SONS,

Successors to HERRING & FLOYD,
Oregon Iron Works,

West 20th and 21st Streets, Between 10th & 11th Avenues, New York City.

Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF ALL KINDS OF CASTINGS AND GENERAL IRONWORK FOR GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings, Condensers, Tower Scrubbers, Mechanical Scrubbers, Purifiers, Malleable Iron Retort Lids, Self-Sealing Retort Lids, Hydraulic Hoist Purifier Carriage, Crosses, Tees, Bends, Angles, Reducers, S-Bends, Sectional Sleeves, Plugs, Caps, Street Drips, etc., always on hand.

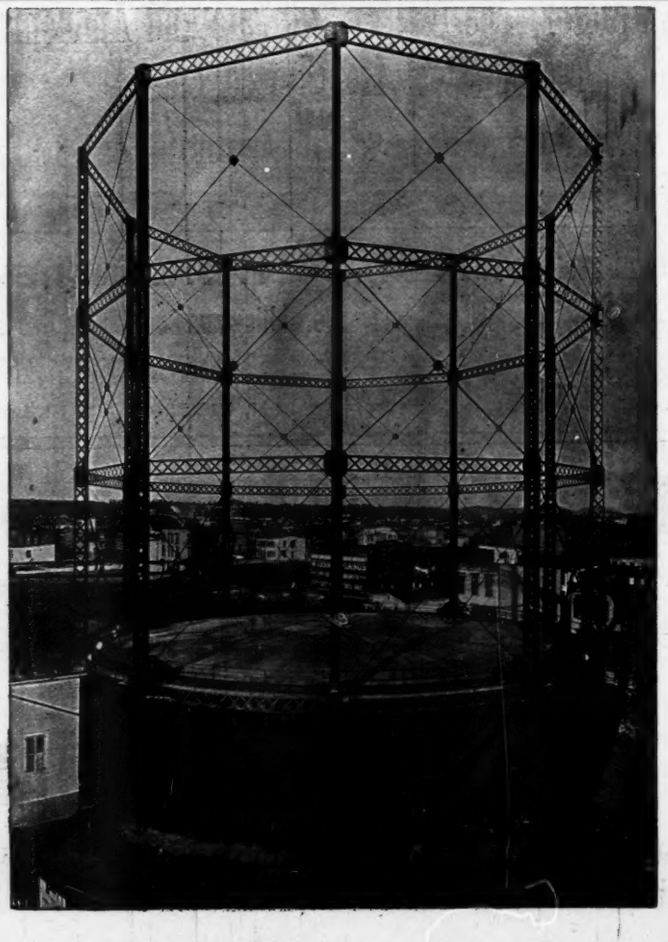
WOOD'S GAS SCRUBBING AND ENRICHING APPARATUS.

In use at Syracuse, Auburn, Watertown, Cortland and Geneva, N.Y.; Elizabeth, N. J.; Boston, Mass.; Jamaica Plain, Mass.; Providence, R. I.; Northern Liberties Gas Co., Phila.

Sole Manufacturers of the OGDEN QUICK-MOVING VALVE.

Premium Awarded, World's Columbian Exposition.

HEARNE CENTER SEAL, Operating One, Two, Three or Four Boxes.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu. Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete with Steel Tanks.

BENCHES, SCRUBBERS,
CONDENSERS,
PURIFIERS, IRON ROOFS,
Self-Sealing Retort Lids,
AND ALL PARTS OF
GAS WORKS APPARATUS

Contractors for
Complete Works.

ALSO, SOLE MANUFACTURERS OF

C. W. BLODGET'S
HOT GAS SCRUBBER.

GAS AND WATER PIPES.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS

Columbus, Ohio.

DAVID LEAVITT HOUGH,

26 CORTLANDT ST., N.Y. CITY.

Consulting Engineer.

Investigations and Appraisals.
Designs and Estimates.

Contractor.

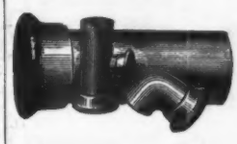
Machinery and Structures.
Gas and Water Pipe.

Special Agent for Selling & Purchasing.

GAS METERS.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

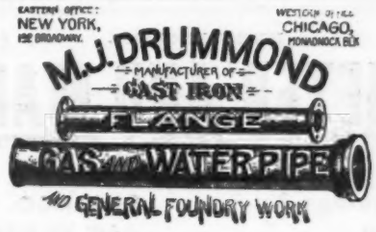


New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

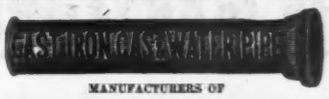
Flange Pipe for Sugar House and Mine Work. Branches. Bends, Retorts, etc., etc



GEORGE ORMROD, Mahgr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA



MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

1894 DIRECTORY 1894

OF AMERICAN GAS COMPANIES

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

SCIENTIFIC BOOKS.

GAS MANUFACTURE, by William Richards. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards, C.E. 20 cents.

PRACTICAL TREATISE ON HEAT AND VENTILATION, with Special Relation to Illuminating, Heating and Cooking by Gas. By E. E. Perkins. $1.25.

CHEMISTRY OF ILLUMINATING GAS. By Norton H. Humphrys. $2.40.

PRACTICAL TREATISE ON HEAT By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

GAS WORKS: Their Arrangement, Construction, Plant and Machinery. $5.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfield. $1.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

COAL, SPONTANEOUS COMBUSTION OF. By Thomas Rowan, C.E. $2.

COAL: Its History and Use. By Prof. Thorpe. $3.50.

THE GAS WORKS OF LONDON. By Colburn. 60 cents.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THE MANAGEMENT OF SMALL GAS WORKS. By C. J. R. Humphreys. $1.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

DIGEST OF GAS CASES. $5.

PRACTICAL HINTS ON REGENERATOR FURNACES By M. Graham. $1.25.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR. By Geo. Lunge. New edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby, F.I.C. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

PRACTICAL PLUMBING. By P. J. Davies. $3.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT: A Manual of Lime and Cement, their Treatmen and Use in Construction. By A. H. Heath. $2.50.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Knapp. $3.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

MAGNETISM AND ELECTRICITY. By J. Overend. 40 cts.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker, E.M. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague, M.I.E.E. $3.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 32 Pine Street, New York.

NATHANIEL TUFTS METER CO.,

63 Beverly Street, Boston, Mass.

MANUFACTURERS OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Apparatus for the Chemical Testing of Gas and Gas Liquor.

Established 1849. With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 107 West Monroe St.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**
BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Perfect" Gas Stoves

THE GOODWIN METER COMPANY,

1012-1018 Filbert Street, Philadelphia, Pa.

MANUFACTURERS OF

Consumers' and Station Meters,

Standard Photometrical and Analytical Gas Apparatus

"SUN DIAL" GAS COOKING AND HEATING STOVES.

Particular attention given to Repairing Meters and Scientific Apparatus. . . . .

GEORGE B. EDWARDS, Agent,
113 Chambers Street, N. Y. City.

METRIC METAL COMPANY,

MANUFACTURERS OF

DRY GAS METERS

For all Kinds of Service.

ALSO MAKERS OF THE

MATCHLESS CLASSIC GAS COOK STOVES AND RANGES.

Send for '96 Stove Catalogue. Factory at Erie, Pa.

GAS METERS. GAS METERS. GAS METERS.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters with Lizar's "Invariable Measuring" Drum.

Agencies:
125 & 127 S. Clinton Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

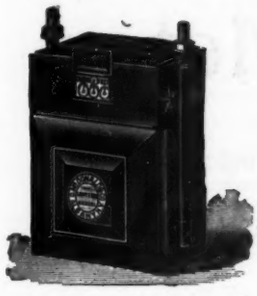
MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.



D. McDONALD & CO.,

Established 1854.

511 West 21st Street, NEW YORK CITY.
51, 53 & 55 Lancaster St., ALBANY, N. Y.
34 & 36 W. Monroe St., CHICAGO, ILL.

MANUFACTURERS OF

Wet and Dry Gas Meters

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS & PRESSURE GAUGES.

Meters of all makers Thoroughly Repaired.

TEODORE D. BUHL, President. CHARLES H. JACOBS, Vice-President and Managing Director.

BUHL STAMPING CO. TRADE MARK RELIABLE GAS METERS DETROIT, MICH. U.S.A.

Buhl Stamping Company,

Detroit, Mich.

Manufacturers of Gas Meters of the Highest Quality.

METER REPAIRING A SPECIALTY. SEND FOR OUR PRICE LIST.

Detroit is one of the best shipping points in the United States for prompt deliveries by rail or water to the East, West or South.

BUHL Meters will need few Repairs. We make our own Tin Plate. Trial Orders Solicited.

The Advertisement of the

OTTO GAS ENGINE WORKS,

33d and Walnut Streets, Philadelphia,

New York, 18 Vesey St. Boston, 19 Pearl St., Chicago, 245 Lake St.,

Occupies this space every alternate week.

JOHN J. GRIFFIN & CO.,

1513-1515-1517-1519-1521 Race Street, Philadelphia.

52 Dey Street, New York. WM. S. GRIBBEL, Manager.

75 N. Clinton St., Chicago. FREDERICK WAUGH, Manager.

MANUFACTURERS OF

STATION METERS, CONSUMERS' METERS,

Provers, Registers, Gauges, Experimental Apparatus, Etc.

Prompt Attention Given to All Repairing.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered. Over 30,000 now in use.

We manufacture in the United States, under the SAWER & PURVES PATENTS, the

Positive Prepayment Meter.

. . SIMPLE . .

. DURABLE .

. ACCURATE .

. RELIABLE .

All Parts Interchangeable

This Meter is an unqualified success in Great Britain. Its simplicity of construction, and the positive character of the service performed by it, have given it pre-eminence.

Needs only the care given an ordinary Meter. Saves MONEY; TIME and CONSUMERS, Dispenses with "DEPOSITS" and increases OUTPUT.